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Cultural Resources Management

Problem Orientation and Allocation Strategies for Prehistoric Cultural Resources on the New Mexico National Forests

PROBLEM ORIENTATION AND ALLOCATION STRATEGIES FOR PREHISTORIC CULTURAL RESOURCES ON THE NEW MEXICO NATIONAL FORESTS

A Document Prepared by the
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Edited by

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FOREWORD

The Nation's forests are managed using a philosophy of multiple use. There are many different kinds of resources on those forests. Development of planning instruments to resolve the competing needs of different user groups has become an important management activity.

For the last decade, managerial awareness of a new set of resources--cultural resources--has increased within the Forest Service. From the perspective of a manager who is not an archeologist, increased awareness has been accompanied by increased concern over some of the directions that cultural resources management seems to have taken. Some interpretations of federal historic preservation law appeared incompatible with our multiple use philosophy since they have been used to argue that virtually every archeological site should be accorded the same management status. Such interpretations have made it impossible to allocate different kinds of sites to different uses. As a result, multiple-use planning was frustrated.

To resolve this problem, we recommended to the archeological community that it attempt, for New Mexico's forests, an effort to plan for wise use of archeological resources in a manner compatible with a multiple use philosophy. We proposed to fund the conference, and were pleased to see the rapidity with which our challenge was accepted.

This document is the first to describe an allocation scheme, for cultural resources on public lands, devoted to alternative uses. In that it examines the relative uses of cultural resources, it allows the incorporation of cultural concerns into multiple use decisions. There is no question that this effort will greatly increase cooperation among archeologists on the one hand and forest managers and users of the forest's other resources on the other.

This first allocation conference was limited to a consideration of prehistoric sites in New Mexico. It was felt that a trial allocation scheme would be better developed and tested without involving the entire vast resource base of the Southwestern Region at one time. It also allowed us to bring together a limited number of scholars to do the job, thus simplifying organizational problems while maximizing scholarly productivity. In order to deal with the prehistoric resources of Arizona as well as the historic and other cultural resources in the region, we are planning two additional conferences.

This volume again demonstrates the leadership role that the Southwestern Region plays in Forest Service cultural resources management. As organizers of the conference and editors of this volume Drs. Fred Plog and Dee F. Green demonstrate the viability of a federal-academic relationship in support of a cultural resources program which is on the leading edge of management and scholarship in the discipline of archeology today.

M. J. HASSELL
Regional Forester

PREFACE

Not all cultural resources should be assigned equal importance. These resources have values that are evaluated differently by different publics at different times. Determining what those values are and assigning values to cultural properties is the purpose of evaluation. Allocation is the process of making decisions concerning the treatment of cultural resources according to the kind and degree of value assigned. Some properties may have high potential for scientific data, others may hold high interpretive potential; and still others may be of great significance in the history, religion, or cultural practices of a community or group.

This document describes the results of a conference held at Ruidoso, New Mexico, in May 1982, to evaluate and allocate prehistoric archeological resources on the National Forests in the State of New Mexico. The participants in that conference were: Drs. Linda Cordell, Dee Green, Tom King, Fred Plog, Michael Schiffer, Pat Spoerl, Joe Tainter, and Steadman Upham. Landon D. Smith was unable to attend the conference but was kind enough to prepare the test case material on the Santa Fe Forest and some of the Appendix materials on SPSS and QWICK QWERY computer runs. Our task was to prepare a document that would advise managers of options available to them during future management actions.

The potential uses of archeological resources on the Forests considered during the conference include: interpretation, information, heritage, and adaptive reuse. The following pages describe the conclusions reached by participants in the conference concerning these issues.

The conference was characterized by a shared belief that the condition of federal archeology needs improvement. From the perspective of the federal archeologists involved, current strategies for managing archeological resources are inadequate and suffer from a preference for ad hoc decisionmaking over systematic planning. The academic archeologists were equally concerned that the pursuit of archeology in the federal framework has led to less than adequate, or even shoddy, research. All were concerned that the payoff of federally sponsored archeology to the public is not currently sufficient in terms of either wise use of dollars or production of useful information to the public.

Out of our joint concern over the direction federal archeology has taken came a solid commitment to provide the Forest Service with an improved scheme for managing its important heritage resources. We were pleased to be a part of this stimulating effort and express our thanks to the participants for their hard work and dedication.

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The conference is indebted to Sotero Muniz, James Overbay, and Paul Weingart, of the Forest Service's Southwest Regional Office. They supported the aims of the conference not only with funding but with enthusiasm for development of a more rational approach to managing cultural resources. A similar commitment was made by John Monagle and Cookie Stephan at New Mexico State University. A number of people contributed directly to the mechanics of making the conference operate and producing this report. We thank Jim Abbott, Paul Gordon, Mike Funston, Jim Keller, Viola Martin, and Valerie Farmer of the Lincoln National Forest, and Fred McGee in the Regional Office. At New Mexico State University, Pamela Davis and Rodger Schvaneveldt spent many hours converting the Forest Service site files to the New Mexico Terak Computer for use at the conference. We want to give special thanks to Des Stuart who served as student assistant to the conference performing the many chores which made the conference both rewarding and pleasant. The services of Lem Chesher, custodian of the New Mexico State Montgomery Biological Research Station where the conference was held are also appreciated. The Advisory Council on Historic Preservation kindly made the services of Thomas King available to the conference. Finally we appreciate the editorial work of David Gillio, and the efforts of Polly Davis and Landon Smith in preparing the Forest Service site file for use. We thank Polly Davis and Joann Mares who typed the manuscript, and Laurel Wallace who prepared the figures.

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INTRODUCTION

Thomas F. King and Fred Plog

PHILOSOPHY OF ALLOCATION

Over 5000 prehistoric archeological sites have been recorded on the National Forests of New Mexico, and thousands doubtless remain to be found and recorded. These range from huge pueblo ruins with hundreds of rooms and extensive subsurface deposits, to surface flake and potsherd scatters of unknown cultural affiliation and age. Collectively, these prehistoric remains comprise an important element of the cultural resource base that must be managed by the Forest Service together with the other resources of the forests.

The mandate to manage archeological sites is derived from a number of statutory authorities. The Federal Land Management Policy Act of 1979 includes archeological and historic resources among the resources that must be considered in forest management. The Antiquities Act of 1906 and the Archaeological Resources Protection Act of 1979 give the Forest Service responsibility for protecting archeological sites from despoliation and for regulating their scientific use. The National Historic Preservation Act of 1966, as amended, directs the Forest Service to undertake the identification and management of historic properties, including archeological sites (Section 110) and to take such properties into account in planning actions that it undertakes and regulates (Section 106). The Archeological and Historic Preservation Act of 1974 authorizes the conduct of archeological data recovery operations when such sites are threatened.

This plethora of statutory authorities is an impressive expression of national policy, but the very fact that such a number of authorities apply creates management problems. Each statute carries with it different definitions, policies, and directions, which while not necessarily conflicting with one another do create the potential for confusion. A recent study by the General Accounting Office (GAO) discussed the extent of such confusion existing among agencies across the country, and called for a higher degree of coordination. This study specifically recommended improvements in the Forest Service's systems for identifying, evaluating, and protecting archeological sites (Comptroller General 1981:22).

The Forest Service, like other land managing agencies, has a serviceable mechanism for resolving confusion about the management of archeological sites by virtue of its authority to undertake comprehensive planning (National Forest Management Act of 1976). Integral to the Forest Service's planning system is the concept of planned allocation of resources. This means that, based on an overall understanding of the resource to be managed, categorical decisions are made about uses for given elements of the resource. These categorical decisions then are used to guide later decisionmaking about the allocation of specific resources. The manager faced with a decision about what to do with a specific site proposed for a particular use has standards to apply in deciding whether such a use is appropriate. Planned allocation gives us a context in which to bring together the requirements of all the pertinent statutory authorities at a programmatic level, designing a system that carries out their intent in each subsequent on-the-ground case.

This approach to carrying out the Forest Service's managerial responsibilities is congruent with the recognized needs of modern archeology. The archeological community has invested a substantial portion of its recent collective efforts in exploring the appropriateness of a variety of scientific techniques and methods. These include statistical and mathematical techniques, computers, and more formal logics of inquiry. While the level of disagreement concerning any specific application remains high, a number of beneficial effects on which there is agreement can be identified. For purposes of this discussion, two such issues are relevant. First, it is widely agreed that the likelihood that a particular research effort will succeed is increased when its problem focus is made explicit in advance. Second, it is

recognized that the likelihood of success in research is increased when a specific research design has been prepared describing the manner in which the research will be done.

Research during previous decades has had both problem foci and research designs. What has changed during the last decade, however, is the degree of explicitness demanded by the professional community and the level of effort devoted to "thinking through" the research process before it actually begins. Archeologists now realize that better decisions about the options that arise during fieldwork can be made in a context in which some data have been identified as relatively more important than others.

A parallel dialogue, albeit up to this point a less fruitful one, has been ongoing among archeologists whose primary involvement is in cultural resource management. This discussion has focused on the concept of "significance" and the ability of archeologists and managers to determine whether particular sites should be identified as significant and recommended to the Keeper of the National Register of Historic Places as eligible for inclusion in the Register. In practice, most such decisions have been made on an ad hoc basis by archeologists and federal or state managers who, in essence, negotiated the fate of sites with at least as much reference to the political affairs of the moment and the availablity of funds for data recovery as to the intrinsic significance of the sites in question.

A growing body of professionals is now arguing that political determinations of the scientific importance of the knowledge potentially contained in archeological sites are inappropriate. They believe that importance can be evaluated only in relation to factors such as critical local, regional, and national research questions that might be answered using the knowledge in question. Also of importance are the kinds and quality of sites being actively preserved that have similar information potential, and the number and kinds of sites from which similar information has been taken and made available for study. It is argued that the explicit formulation of research topics and explicit decision-making about the relevance of different kinds of sites to these topics is fundamental.

It is clear that the planned allocation of archeological sites by the Forest Service is the managerial equivalent of, and to some extent incorporates, good archeological research design. It is this philosophy that underlay the conference and produced this book.

Certain principles were integral to our discussions. First, we recognized that prehistoric archeological sites collectively constitute a nonrenewable resource which, with respect to some kinds of sites, is also a scarce resource. Such sites constitute an important source of information concerning prehistory, a time period that encompasses over 99 percent of the time of human occupation of the planet. Because these sites are virtually the only available sources of such information, and because they cannot be renewed, the use of such sites by scientists to obtain information must be carefully managed. Therefore, the criteria for using archeological sites on the forests should be especially clear.

Management in this context includes both preservation and conservation. Preservation refers to maintenance for future use. A site allocated to preservation will not be used for research that disturbs the site except when the archeologist proposing to so use it can produce: (1) a research design of the very highest quality, which addresses a critical research question; (2) a clear demonstration that the question has not been answered using information from sites that have already been used; and (3) a clear demonstration that there are no alternative sites to the preserved site whose use is proposed, at which the research project in question might be carried out.

Conservation refers to regulation of use of less critical resources. While a good research design is necessary for the use of conserved sites, the test with respect to available alternatives need not be so strenuous. In essence, preserved sites are those that have been reserved for the future, while conserved sites are those that may be used with greater equanimity when management or research needs so require, though their preservation is still a central intent.

In considering the use of prehistoric sites, we have focused our discussion on research uses. Clearly, such sites are also used for other purposes; most importantly, they may be destroyed in some cases to make way for projects serving other critical public needs. The allocation strategy proposed here has applicability to decision-making about which sites should be destroyed and which should not; sites allocated for preservation should be preserved in place in every case, while those allocated for conservation need not. This is not to say that conserved sites should not be preserved, but only that such sites may be sacrificed, subject to adequate data recovery, where the public interest demands it and preservation in place is not feasible and prudent.

Certain prehistoric sites may also be allocated, exclusively or in part, to use for public interpretation, to adaptive reuse, or to heritage use. A given site may become the focus for an interpretive development. A prehistoric structure might be reused for administrative purposes (such as Gila Pueblo), or a prehistoric shrine might be regarded by a Native American community as having continuing religious significance. These cases are rare enough, however, that they can be handled adequately on a case-by-case basis, so they have not been major foci of our attention. All prehistoric sites are potentially assignable to allocation categories based on their information content, so it is to this task that we have directed our attention.

For similar reasons, our focus here is on prehistoric sites, that is, archeological sites dating in whole or in part from time periods before the extensive intrusion of Europeans into the area. Sites, structures, and other properties dating from post-European historic periods present a somewhat different range of problems that must be confronted in allocation. Although many of these sites have information value, many also attain significance based on their interpretive potential, their heritage value, their association with particular events or processes in history, their association with important individuals, and their architectural values. Such resources will be the subject of a subsequent conference.

While planning for the wise use of cultural resources has been a concern of the Forest Service for over a decade, the evolution of an explicit approach to planning has been a gradual one. As Deputy Regional Forester James C. Overbay has noted, "During its first decade (the 1970s) cultural resource management has been more concerned with compliance than with management." (Plog 1981:iv). This statement accurately reflects the levels of effort that regional and forest archeologists have invested in these alternative activities.

Yet, from the very beginning of the 1970s the importance of planning has been growing. In 1971 as the final report for the Mogollon Rim Planning Unit (USDA Forest Service 1972) of the Apache-Sitgreaves National Forests was being completed, Fred Plog was asked to use survey data collected that summer to prepare a map of high, low, and intermediate site density areas for the plan. While a meager beginning, this map represented the first attempt to include distributional data on cultural resources in forest planning.

In 1974 Dee F. Green, Regional Archeologist for the Southwestern Region, asked Plog to design and execute a sample survey of the White Mountain Planning Unit. This was done and a report was prepared by Bruce Donaldson (1975). This survey was the first done specifically for planning. While it did describe the distribution of sites, attention to actual managerial issues was limited.

In 1976, the Apache-Sitgreaves Forests again asked Plog for a planning survey, this one of the Little Colorado Planning Unit. The published report (Plog 1978) included papers exploring the information potential of sites and incorporated information of value to planning. The report also included recommendations for administrative studies to enhance understanding of the resources and for interpretive displays. Alternative uses were evaluated albeit to a minimal extent.

A second approach to the current effort began in 1977 when Linda Cordell was hired by the Regional Office to prepare an "overview" of the Middle Rio Grande Valley, New Mexico, for the Forest Service and the Bureau of Land Management. The purpose of

the study was "to provide an evaluation of what and how much is known about the cultural resources within the study area in order that the significance of these resources may be developed in the light of present understanding" (Cordell 1979:1). Subsequently, overviews were published for the Socorro Area of New Mexico by Mary Jane Berman (1979), the Mt. Taylor Area of New Mexico by Joseph Tainter and David Gillio (1980) and the Upper Little Colorado Area of Arizona by Fred Plog (1981a). In the Tainter-Gillio overview (1980:vi) the agencies involved specifically note the relevance of the overviews to the formulation of land use plans.

In 1978 and 1979 Plog again worked for the Forest Service preparing the overview for the Little Colorado and a background document to the Forest Plan for the Apache-Sitgreaves Forests (Plog 1981b). That document proposes a variety of specific management alternatives and alternative uses of sites in the area. However, it neither formalizes these alternative uses nor proposes means of allocating sites to these uses.

Currently the Forest Service categorizes cultural resources into three groups: those which are National Register eligible, those which are not, and a very large grouping of properties which have not been evaluated for National Register status. This scheme was developed in the mid-1970s when compliance with section 106 of the National Historic preservation Act was the hallmark of dealing with cultural resource sites. With the shift in emphasis toward management and planning, the need for a new scheme was recognized and an initial formulation was suggested by Green (DeBloois, in press) at a High-Altitude Seminar held in 1980 at the School of American Research in Santa Fe (Winter, in press). Subsequently, the Washington Office of the Forest Service began development of a classification scheme based on Green's initial formulation. That scheme is currently undergoing review and the results of this conference may affect it.

This brief history brings us to a meeting in the fall of 1981 attended by Sotero Muniz, Deputy for Administration, James C. Overbay, Deputy for Resources, Paul D. Weingart, Director of Recreation, and Dee F. Green, Regional Archeologist, all of the Southwestern Region. The focus of their discussion was how the Forest Service could begin to prepare a plan for cultural resources that was management rather than compliance oriented. The need to formulate a scheme for making actual allocation decisions about cultural resources was the product of that meeting. It was also at that meeting that the decision was made to hold this conference.

FOREST RESEARCH TOPICS

In order to manage archeological sites for their information potential it is necessary to establish methods for determining the degree of such potential a given site or category of sites is thought to possess. Without such methods, managers are left without a rational basis for decision-making about allocation; every site is perceived as having equal scientific potential, leaving managers with the options of treating all sites equally or making allocation decisions ad hoc, and in some cases, post hoc.

The need to define research topics as a basis for allocation decisionmaking has been succinctly noted recently by the GAO, which urged that federal agencies be required to:

> Define specific significant research questions to be addressed in data recovery, in order to justify archeological excavation costs. (Comptroller General 1981:52).

Research topic definition is no less needed in decisionmaking about long-term management and permitted activities than in decisionmaking about data recovery. The decision to manage a property over a long period of time is an investment decision on the part of forest management, which carries with it implications of maintenance costs and alternative uses foregone. The decision to permit an archeologist to excavate a site on a forest for research purposes represents a conclusion by management that the public property in question should be invested in the proposed research, rather than reserved or used for some other public purpose.

Thus, the formulation of archeological research topics is a key feature of this allocation strategy; such topics will

provide a major basis for decisionmaking about long-term management, about which permitted uses of archeological sites to allow and which to discourage, and about how to structure needed data recovery efforts.

King (1982) has proposed the establishment of National Archeological Research Topics (NARTS) as a basis for agency decision making across the government and across the nation. We possess no equivalent grand pretensions, but our approach is not inconsistent with King's.

We examined the history of archeological investigation in New Mexico and the current archeological literature, considered the directions in which archeological research may go over the next several years, and thought about just what it is that archeology can best contribute to the corpus of knowledge. From this we have devised three major research topics to which studies of archeological sites on the forests of New Mexico should be directed; these are called Forest Research Topics.

Although the three Forest Research Topics are quite broad, they necessarily exclude some studies that could be done on archeological sites in the National Forests of New Mexico. A key factor in establishing the topics has been the concept of relevance; in a nutshell, we have asked ourselves, "what is the relevance of this research topic to humankind?" In order to qualify as a Forest Research Topic, carrying with it the expectation that public resources will be invested in its study, we have required that the topic have a demonstrable potential payoff for the public. The three topics selected have such potential. The first does because its study can enable us to better understand our own society and its future. The second should enable us to predict future environmental conditions in the area. The third should elucidate a past event--the depopulation of the area in the 12th through 14th centuries --that could recur in the future.

We see these three topics, all designed to make data about the past meaningful to the present and future of mankind in the Southwest and beyond, as the most important to address over the next 5 years; hence they are assigned priority as bases for allocation decisionmaking. At the end of 5 years progress toward resolving the research questions that the topics carry should be assessed, and the allocation strategy adjusted as necessary. The Forest Service is open to the consideration of research questions that are not derived from the Forest Research Topics. However, when it is proposed to allocate an archeological site, managed by the Forest Service, to addressing a research question not derived from a Forest Research Topic, the burden of proof will be on the proposer to demonstrate that the allocation should occur.

Topic A
The Rise and Fall of Civilization

We live today in a complex civilization composed of many population centers linked together by complicated economic, social, and political ties. The more we understand about how our civilization works, the more easily we will be able to cope with its complexity, and with the changes and the challenges that will inevitably confront it in the years ahead. The fact that our own civilization is very complicated, however, makes it difficult to study directly; it is difficult to sort out the major principles and processes that make a civilization work or fail to do so when the civilization is very large and complex and when one is living in it.

Archeology provides a unique opportunity for looking at the very large number of civilizations that have existed in the past, and seek the general principles and processes that underlay them. The majority of such civilizations left few or no written records and thus are knowable only through archeological research. Since the many extinct societies studied by archeology have not survived, we can also try to determine what causes a civilization to collapse. By understanding such principles, we should be able to make predictions about the future of our own civilization.

The prehistory of New Mexico is characterized by the rise and fall of a succession of societies in various regions of the state. Although much simpler in organization than our own, many of these, for example the society responsible for the Chacoan system, were highly organized with elaborate trade systems, complex social organizations, and diversified economies. Understanding how and why these societies

developed and declined is an extremely important research topic which has served as the basis for much fruitful archeological research in New Mexico in recent years. Many more questions remain to be addressed than have yet been answered by this research, however, and many of these can be addressed using archeological sites on the forests.

The investigation of this topic has value that goes beyond its scientific importance. It will provide the basis for public interpretation of many sites and it is also a topic of considerable historical importance to many of New Mexico's citizens, both native and immigrant.

Within the general topic, the following more specific questions have been identified for investigation at archeological sites on the forests.

Question 1: Why did prehistoric people begin to live in sedentary communities? Throughout human history, most societies have been nonsedentary; they have moved over their territory in search of food and other resources, settling only for short periods of time. Even today, there are societies in which both nomadic and sedentary life styles occur and in which the former is the preferred pattern. The establishment of sedentary communities was an important step toward the development of complex, urban societies. We do not know why such communities were formed, nor do we know what were the effects of their formation on the biological, psychological, and social systems of humans who were the product of millions of years of adaptation to a nomadic existence. Nor do we know how our own relatively sedentary lifestyle affects us.

Question 2: What processes are involved in the development of large and complex social systems? Some sedentary communities grow and become organized into large and complex societies while others do not. We do not understand the processes involved. We do not know what sort of lifespan is characteristic of large and complex prehistoric societies, nor the effects of living in larger and larger, more and more highly organized groups.

Question 3: What are the causes and effects of the development of agricultural systems? The development and elaboration of agricultural systems are important factors in the growth of complex societies. We need to better understand the reasons for the adoption of agriculture in the Southwest, the reasons for the development of specific technologies and crops, and the effects of changing agricultural systems on the societies that managed them and on the environment in which they operated. One cannot assume that the shift to agriculture was an easy one. It was probably accompanied by a higher incidence of disease and may have required a greater investment of labor than was typical of the hunting-gathering strategies that preceded it. We need to know more about these factors for a very direct practical reason as well. The effectiveness of prehistoric agricultural systems and their effects on the natural and social environments can be studied to suggest how well equivalent modern agricultural systems will work over the long run, and what their effects may be. Soil salinity or alkalinity in some areas of the Southwest, for example, may reflect over-utilization of the soil by prehistoric agriculturalists.

Question 4: What patterns of productive specialization and exchange existed in prehistoric New Mexico, and what were their causes and effects? Like the development of agriculture, the development and elaboration of trade and exchange systems, and of specialization in the production of goods, are important factors in the development of complex societies. For the Southwest, current data suggest that specialization existed in the production of goods such as ceramics, shell, chipped stone artifacts, and turquoise jewelry, and that exchange systems shifted in their size, complexity, and orientation through time. We do not understand the magnitude of productive specialization and exchange, their variations through time and space, or their relationships with other aspects of changing social systems.

Question 5: What was the nature of ethnic and intercultural relationships in prehistoric, protohistoric, and ethnohistoric New Mexico? For several hundred years, a variety of Puebloan, Athabaskan, Yuman, Cibolan, and other populations have interacted in and around New Mexico. Social, political, and economic organization varied widely among these groups.

About 400 years ago, these people came into contact with an alien culture, the Spanish. The ways in which all these diverse social groups interacted over the centuries may tell us much about how differently organized societies relate to one another in general, and can help us better understand the modern populations of the area and their relationships.

Question 6: What social entities existed in prehistoric New Mexico, and how did their characteristics change through time? Fundamental to most of the other studies needed to address this research topic is the need to describe the societies that existed at different times and in different parts of prehistoric New Mexico. We must determine their boundaries as well as is possible, to study how they differed from one another in terms of their patterns of settlement, their means of subsistence, and their social organization, and to study how they changed over time. Further, we need to seek the causes of such change, and generally to understand why, at some time periods, there seems to have been great social diversity across the state while at other times there was little.

Topic B
Environmental Change

Accurate data on weather patterns around the world have been collected only for about the last 150 years. Today, great weight is placed on these data as a basis for predictions about next year's or the next decade's rainfall, streamflow, wind patterns, and agricultural productivity. It is very risky to base such important assumptions on data representing such a short period of time. The city of Phoenix, Arizona, for example, has had three "100-year floods" in the period 1977 to 1982. A variety of scholars are now seeking evidence of past environmental conditions using a great many kinds of natural and cultural evidence. The basic purpose of paleoenvironmental reconstruction is to establish what patterns have existed in past climates, as a basis for predicting what patterns will apply in the future and what their effects may be. Archeology in New Mexico can make major contributions to paleoenvironmental reconstruction. These contributions fall generally under two subtopics.

Question 1: What is the history of human land use and its effects on the natural environment? By studying where people settled, what their numbers were, what resources they used and to what extent, where they placed their fields if they were farmers, where they hunted and gathered whether or not they were farmers, and how these patterns of activity changed over time, we can help determine how much of what we think of as the natural environment is actually of human origin. Today, for example, forests in many countries are disappearing at a rapid rate and causing shortages of fuelwood and construction materials. At some times in the prehistoric past, similar problems may have arisen. Understanding this can help us to factor out those environmental changes that have been induced by humans, so we can better study natural environmental change. At the same time, it can help us understand how fragile or how resilient the natural environment is to different kinds of stress that humans may place upon it, and whether there are productive strategies different from those currently in use that would be less detrimental to the environment.

Question 2: What have been the patterns of natural environmental change over the last 10,000 years or so? By studying the archeological record of human relationships with the environment, coupled with geophysical and botanical data that reflect environmental characteristics directly, we should be able to plot the frequency and magnitude of environmental changes through prehistory and to determine roughly what the natural environment was like in any given area at any given time in prehistory. Patterns of change can then be projected into the future, and likely future environmental conditions described.

Topic C
Abandonment/Depopulation

Question 1: Why do people abandon sedentary communities? At a number of times in the past, in New Mexico and elsewhere, sedentary societies have broken apart into small, mobile bands of people. On the whole, we do not know why such events happened, nor what processes were involved in the transition from a sedentary to a mobile lifestyle. Such a change could represent no more than a return to a

preferred lifestyle; but it could also be the result of environmental or other difficulties with maintaining sedentary settlements. We do not know the effects of such a transition on the people who were involved.

Question 2: What caused the depopulation of A.D. 1100-1300? Between 1100 and 1300, large areas of the Southwest seem to have been abandoned. At least, large semi-urban centers and obvious villages were abandoned; either the population left the area entirely, or it shifted to a form of organization and land-use that has left little or no identifiable archeological evidence. We need to know what caused this depopulation, because whatever caused it could happen again, here or elsewhere. It would be wise for us to understand fully such phenomena that occurred in the past, so we can anticipate them and perhaps control them in the future, particularly since our society has produced huge population aggregates that are not individually self-sustaining, and that may be vulnerable to whatever caused the depopulation 700 years ago.

These questions will constitute, we believe, the archeological focus of cultural resource management on the New Mexico Forests for the next several years. The following chapter describes the research and development needs that must be addressed to realize the potential of these cultural resources. We then describe the allocation strategy derived along with two test cases from forests with highly different data bases. Recommendations for implementation and a summary of what we think the project means to both the Forest Service and the profession of archeology round out our contribution to this endeavor.

RESEARCH AND DEVELOPMENT

Linda Cordell, Michael Schiffer, and Steadman Upham

INTRODUCTION

The Forest Service allocation plan will direct archeologists working on the Forests --as employees, as contractors, and as permittees--toward projects that address the Forest Research Topics discussed above. In each case where a permit is requested to excavate a site on a National Forest, or where data recovery is proposed in response to a management or compliance requirement, archaeologists will be expected to develop research designs that relate in positive ways to one or more of the Topics.

In considering the establishment of these Topics, however, we have recognized that there are fundamental impediments to addressing them effectively. These impediments include data gaps, uncertain or possibly misleading interpretations of archeological phenomena, and unclear or nonexistent models of critical cultural and natural processes. Our ability to effectively address the Forest Research Topics will be unduely limited until some of these impediments are overcome.

In this chapter we discuss the major impediments we see to addressing each Forest Research Topic, and propose research and development efforts that we feel could productively be applied to each. Research and development efforts are viewed in two compatible categories: those that may be undertaken by the Forest Service and those that are more appropriately addressed by the academic community or that community working in cooperation with the Forest Service. The Forest Service encourages academic archeologists to seek funding from outside agencies to pursue research on archeological sites along the lines discussed in this chapter. The research and development efforts proposed here should also be integrated where feasible with survey and data recovery projects, addressing Forest Research Topics, that are undertaken in response to management and legal requirements.

It should be recognized that several of the issues discussed here are interrelated and an approach to one may inherently involve dealing with others (see Schiffer and McGuire 1982). For example, approaching the issue of depopulation/collapse in the 12th through 14th centuries necessarily leads to resolving questions about chronology and the unidentifiable sites category. Similarly, understanding the distribution of specific artifact types requires an understanding of their chronological placement, use-life and context of deposition, as well as information concerning manufacturing localities and, in some cases, modes of exchange. Given the interdependence of research topics, we are especially concerned to promote the development of research designs that delineate these linkages and that specify relevant data and analyses.

TOPIC A: RISE AND FALL OF CIVILIZATION

1. Sedentism

Traditional interpetations of the transition from hunting and gathering to sedentary agriculture do not address cause in other than a vitalistic fashion.

Moreover, the transition to sedentism is viewed only as a one-way process; that is, it is assumed that once sedentary settlements develop, their residents do not revert to high mobility strategies. Modern permanent Pueblo communities have been generally accepted as suitable models for large prehistoric Pueblo settlements. Year-around and long-term occupation of prehistoric sites is thus assumed without considering the potential range of sedentary/mobile strategies. We suggest that seasonal or occasional use of even quite large pueblos may have occurred. We must also consider the coexistence of different adaptive patterns emphasizing differential rates of mobility in the same region. Such dual patterns are obscured, in many cases, by low visibility of the more mobile strategy. Mobile groups may leave not only fewer artifacts but should produce functionally distinctive assemblages. These issues demonstrate the need

to reevaluate current settlement models and their archeological implications, as the following potential research Topics illustrate.

a. We need better ways to recognize and conceptualize the varieties of sedentism and residential mobility. Particularly, the traditional criteria used to infer sedentism need to be reexamined. One way of approaching this issue is a systematic search and synthesis of cross-cultural and ethnoarcheological information pertaining to sedentary and mobile behavior. For example, the presence of structures in Archaic contexts, presumed to have been produced during a time of highly mobile adaptations, is well documented in the Southwest, the Great Basin, and the Plains (Frison 1978; Martin et al. 1949). Clearly, the presence of structures is not a sufficient basis for an inference of sedentism.

b. Given appropriate paleoenvironmental baselines, simulation models of hunter-gatherer behavior under conditions of reduced mobility need to be undertaken. The current information derived from the !Kung (Cashdan 1980; Hitchcock and Ebert in press) suggests some of the responses occasioned by reduced mobility. However, it is obvious the !Kung are not necessarily appropriate analogs for all archeological situations; broader cross-cultural examples are necessary. In conducting these studies it should be emphasized that reduced mobility can result from a variety of causes, including encroachment of other groups, population growth, environmental degradation, and the presence of windfall resources.

c. Research is needed to delineate resource distributions and the scheduling activities of Archaic populations in various paleoenvironments. Similarly we have little understanding of potential scheduling conflicts between agricultural and nonagricultural food procurement activities. These relationships must be considered in light of agricultural practices that vary greatly in intensity. Nevertheless, agriculture is an additional labor requirement imposed on a hunting and gathering regime, even if it is highly productive. Until adequate distribution maps of particular economic resources are available, scheduling conflicts identified and differential labor investments understood, it will not be possible to address the larger and more important question of whether or not agriculture-based sedentism is a last resort or a beneficial innovation that would be readily adopted at the first opportunity.

d. Changes in patterns of mobility have important consequences for populations. We need to know more about the demographic consequences of sedentism at local and regional scales. Many studies suggest that population growth is a concomitant of reduced mobility (Binford and Chasko 1976). Yet this problem has been investigated only under a limited range of conditions. Some investigators have proposed that the pithouse to pueblo transition can be understood as a response to increasing sedentism resulting from a greater dependence on agriculture. The persistence of pithouses in some areas of the Southwest into the early 20th century (Cordell in press) calls such interpretations into question. Remodeling of habitation units in different kinds of sites located in different environmental settings has traditionally been interpreted as reflecting sedentary patterns and in situ population growth. Refined excavation techniques and refined interpretive models indicate that remodeling patterns may be related to seasonal or periodic use of a particular locality and certain structures.

We need to examine the use-lives of various kinds of structures and structural materials, as well as investigate general principles of inter- and intra-settlement space use (cf. Hunter-Anderson 1977; Powell 1980). Historic structures on forests may be an appropriate data base for some studies. Another line of evidence pertaining to this issue is the technological changes in material culture that are purported to have accompanied the shift to sedentism. Analyses are required to determine the techno-functions of various artifact classes (e.g. manos, metates, hoes, axes, and adzes) as well as the diversity of artifact classes traditionally associated with sedentary behavior. Ethnoarcheological studies should be useful in clarifying some of the material correlates of sedentary behavior.

e. Increased storage of food items is viewed traditionally as a concomitant of

sedentism. Although a diversity of storage techniques and facilities is apparent in many areas of the Southwest we do not fully understand the functional requirements for storing particular kinds of resources for different periods of time in different environments. Nor do we understand why different kinds of storage structures and storage spaces are used for different purposes. Again, enthnoarcheological and experimental research can contribute to resolving these problems.

f. The study of storage facilities may also contribute to the evaluation of paleoenvironments. The distribution of "small sites" in various areas of the Southwest and of some very large sites in unusual high elevation settings (Jemez District, Santa Fe National Forest) suggests that such sites might have served primarily as storage facilities. Consequently, population estimates derived from site and room counts that include these structures may be inaccurate and in need of reevaluation. Pertinent baseline information should indicate the amounts of stored resources necessary to sustain groups that are sedentary over varying periods of time. We need to identify the storage space requirements for groups of different sizes that are sedentary for one season (i.e., the winter) versus amounts needed for longer periods of time.

2. Large Settlements and Complex Systems

Traditionally, the Southwest has been viewed as an area in which complex socio/political systems did not develop. One of the most important contributions of recent archeological work has been the recognition of the in situ development of large, complex regionally organized socio/political systems (e.g., the Chaco Phenomenon and the Fourteenth Century Regional System). These findings have changed our view of southwestern prehistory. In addition, the new interpretations make it incumbent upon southwestern researchers to use their data to evaluate current evolutionary models of the development of complex societies that are proposed to have universal applicability (e.g., Big Man models, hydraulic agriculture models, models of trade and exchange, ideological models involving pochteca or others, gateway models, population/resource imbalance models, world system models). Because the Southwest never moved beyond an apparently intermediate level of socio/political complexity, testing these models in a southwestern setting may have broader developmental implications (McGuire and Schiffer 1982).

a. A number of theoretical models that purport to explain the evolution of socio/political complexity invoke external "causal" variables. At the same time, many investigators attribute the basic causes of development to internal processes (e.g., population growth, aggregation, and organizational succession). These divergent views, because they are key to interpreting general cultural evolution, are of great importance to archeologists and ethnologists in general. The Southwest, in part because it offers the potential for refined paleoenvironmental reconstructions and chronological control and in part because of the presence of numerous large settlements where crucial data may be extracted, is a most appropriate location for attempting to resolve these conflicting views.

b. A critical part of most interpretations that deal with developing organizational complexity involves discussions of specialization and regional exchange. In the Southwest, data suggest that both processes were important. However, at present we do not know the extent of productive specialization, nor do we fully understand what role specialists played in particular prehistoric societies. There are indications that specialists may have been incorporated into status hierarchies. It is likely that some commodities were produced by specialists and exchanged over long distances. Some studies indicate that certain commodities had restricted or differential spatial distributions (Upham et al.; 1981; Upham 1982). More studies of this kind are required and refinements in these studies are needed. What are the data that indicate specialization and what kinds of models are appropriate for identifying exchange networks? Patterns of artifact and attribute variability that relate to the symbolic functions of artifacts need to be explored. Clearly, the emergence of large settlements is generally accompanied by changes in artifact types and styles. Can we relate these observations to patterns of social differentiation and integration?

c. Presently, the process of aggregation is poorly understood and as a result is generally attributed to climatic change. We need to understand better the way(s) in which large settlements grew. This can be accomplished by developing site occupational histories. We need to examine further the questions posed by evidence of population influx on the one hand and internal population growth on the other. Clearly, questions of this sort will require detailed intra and intersite chronological control in order to compare rates of growth within and between settlements. At the same time, pertinent paleoenvironmental reconstructions are necessary in order to evaluate further the contention that aggregation is related to climatic change.

d. A usual concomitant of complex organization is the development of status differentiation. This is also generally assumed to be manifest in fairly obvious ways, such as differential use of space, differential access to luxury items and the like. In the Southwest, some data indicate that differential treatment of the dead can be used to infer status differences (Whittlesey 1978). In some cases, variability in treatment of the corpse, grave goods, the nature of the grave and its placement furnish the basis for analyses of status differences (Tainter 1978). It is unclear how the axes of variability in each of these are related. We would not expect the manifestations of status differences to be uniform across very broad areas or at different times. Therefore, attention should be given to further refining the differences reflected in burial practices. We also need to elucidate the fundamental issue of what status differences entailed in terms of differential access to resources. To pursue this question, data on nutritional differences among groups of burials should be gathered.

e. A dimension that is critically important in the organization of both extant Pueblo societies and societies generally classified as complex in the evolutionary literature is the restriction of access to information. Some ethnographic studies indicate that the most powerful determinant of status is access to sacred or esoteric knowledge (Brandt 1977). Unfortunately, we have very few models which enable us to relate information control to observable material phenomena. However, we suggest the systematic exploration of certain categories of information, such as standardization of measurement, that may be reflected in architecture. Another avenue of potentially productive research involves studies of stylistic homogeneity and the information content of particular artifactual or architectural styles. Such an approach will involve the continued examination of the spatial distribution of stylistic attributes.

f. Spatial analyses of southwestern sites have identified the regular spacing of large settlements during some time periods (Upham 1982). These studies also indicate that many of these large sites apparently had no sustaining "hinterland" populations, as would be expected. Studies done by economic geographers and by ethnographers indicate that sustaining hinterland populations are common features of large settlements in most areas of the world. In other words, the Southwest is either unique or we are failing to observe an important component of its complex settlement systems. This becomes especially significant in light of the possibility that many of these settlements could not have sustained themselves by relying on locally available resources. We must investigate the possibility of mobile and sedentary populations coexisting and interacting in exchange relationships for critical resources. Chronological refinements are important to interpreting the possible role of small sites, many of which are thought to be earlier than the large settlements but may not be.

g. Distributional studies are needed as a first step in clarifying the relative importance of environmental versus social relationships in the positioning of large settlements. To what extent are local environmental resources, such as water and arable land, key determinants of large settlement locations? Alternatively, to what extent are relationships between and among settlements overriding concerns? In order to assess locational decisions, we need to establish and use behaviorally appropriate measures of distance (e.g., walking hours as opposed to airline miles, taking barriers into account).

3. Agriculture

Clearly, the adoption and widespread use of agriculture as a component of the prehistoric subsistence base in the Southwest is related directly and indirectly to the issues of sedentism and paleoenvironmental reconstructions. Many research questions relevant to this topic, accordingly, are discussed elsewhere in this chapter. In this section, we will focus primarily on the diversity of agricultural practices and their effects on cultural systems.

Agriculture as a strategy is generally viewed as more labor-intensive than foraging. However, it is not clear at what threshold agriculture in fact becomes more labor-intensive than hunting and gathering. Both hunting and gathering and agricultural strategies are bound to exhibit considerable variability in the investments of labor they entail. Agriculture is usually viewed as a necessary part of complex organizations. While the correlation between an agricultural subsistence base and organizational complexity is manifestly true on a worldwide basis, under certain circumstances complex social systems were maintained without agricultural production (e.g., Chumash, Kwakiutl). How high population densities were maintained, regardless of resource base, is the more important question. Given the variable and relatively low agricultural potential of much of the Southwest, the ability to support high population densities and relatively complex social organizations must be understood in multivariate terms. It is clear that during some time periods and in some areas, labor intensive agricultural strategies were employed. At the same time, in other areas there is little evidence of this type of activity. Clearly, we need to understand why such variation exists and the implications of different subsistence strategies on the course of prehistoric cultural developments in the Southwest (Schiffer and McGuire 1982).

a. We need to evaluate assumptions about the productivity of different strains of cultigens. Some interpretations that focus on the widespread adoption of particular cultigens and on the subsequent change in behavior associated with such a shift indicate that "new and more productive strains" of a particular crop were responsible for its adoption and use. Recent research on maize (Ford 1981), however, indicates that much of the variation in color and size is the result of human manipulation of a genetically diverse and plastic crop. We need to understand what behavioral conditions foster the selection of different kinds of cultigens and why certain cultigens are used to the exclusion of others.

b. We must continue to examine the possibility that prehistoric southwestern agriculture involved the domestication or manipulation of locally available wild plants. It is no longer sufficient to view the agricultural base of southwestern societies as consisting only of maize, beans and squash. We are impressed with the evidence for the possible cultivation of barley in the Hohokam area (Gasser 1981), the possible cultivation and semi-domestication of Agave paryii in the Mogollon area, and the intensive use of Helianthus by many southwestern groups. Research needs to be undertaken to determine whether wild resources were in fact manipulated and, in some cases, domesticated.

c. More refined techniques are needed to examine the agricultural intensity and labor requirements of particular cropping strategies. Archeologists generally assume that the presence of soil and water control devices indicates intensified agricultural practices. The presence/absence of such devices really reflects the difference between areally extensive and areally intensive agriculture strategies. More sophisticated mapping and recording of these features is required and regional distribution maps need to be prepared to determine the extent of such systems. Another approach to this problem involves experimental studies on different types of agricultural features and systems in order to determine the construction and maintenance requirements.

d. We need to reexamine the effects of an agricultural diet on human health. Some studies suggest rather severe iron deficiencies result from an overdependence on maize, but this finding is by no means conclusive. Existing skeletal collections and "mummies" may be used in much of this research (Huss-Ashmore et al. 1982). We hope that refinements in current methods of determining dietary composition from

skeletal material will be pursued (DeNiro and Epstein 1978, Vogel and van der Merwe 1977).

e. The introduction of cultigens to the Southwest is believed to have been the result of contact with groups living in northern Mexico. A dialogue needs to be established with both Mexican archeologists and U.S. archeologists working in northern Mexico. Specifically, we do not yet know the distribution of early cultigens in this area. Another related area of inquiry would be an examination of variation in cropping strategies practiced in northern Mexico.

f. Various models of climatic change and particularly drastic environmental degradation have been correlated with episodes of cultural change, such as depopulation (Euler et al. 1979). Considering the weakness of our chronological data and the variability manifest in prehistoric agricultural systems and strategies, a reexamination of these correlations would seem to be in order. We need to refine our understanding of the resilience of certain agricultural practices and the effects of various climatic conditions on particular cropping strategies.

g. On a different level, we need to refine our techniques for inferring agricultural practices from material remains. Specifically, to what extent do residues on ceramic vessels and grinding implements inform us about prehistoric diet? Can the techno-functions of various "agricultural" implements be determined? Are there differential container requirements for different agricultural and nonagricultural food resources? Can amino acid racemization be used to determine whether noncharred faunal remains have been boiled? Once again, we stress the need to investigate and understand the formation processes of evidence used to infer various aspects of agricultural practices (Schiffer and McGuire 1982).

4. Regional Organization

Among the more interesting contributions of recent archeological research to southwestern prehistory is the recognition of regional political/economic systems that transcended local organizations at various points in time. Documentation of the "Chaco Phenomenon" (Judge et al. 1981) and the "Fourteenth century regional system" (Upham 1982) have necessitated a thorough reevaluation of traditional interpretations of southwestern cultural development. At the same time there has been a growing recognition that current models of hunter-gatherers are inadequate to account for the diversity of regional patterns of adaptation found prehistorically. The distribution of specific raw material resources and perhaps of some "highly diagnostic" artifact styles found in Archaic and Paleo-Indian sites may be markers of information systems among such groups.

The questions outlined in this section concern the development, refinement, and testing of various approaches to investigating the organization of regional systems at all scales.

a. Studies should be undertaken to reevaluate existing models of spatial distributions that are commonly employed in archeology (Hodder and Orton 1976). For example, currently there is no way to assess statistically many quantitative spatial models. In addition, it is unclear to what extent models derived from economic geography and plant ecology are applicable to the systems we wish to understand (Crumley 1979). Simulation studies should be undertaken to compare the results of spatial analyses using varying numbers of data points, areas of different size, different measures of functional and social distance, different distances to boundaries, and the like.

b. It is equally important to develop spatial models for the adequate description and interpretation of societies at different levels of complexity. Distributional studies, studies of interaction and information flow, as well as an examination of cross-cultural approaches to this issue should be productive. Implicit in this research question is the notion of boundaries and boundary maintenance. We need to understand the conditions under which various boundary mechanisms operate, the material correlates of these boundaries, and their persistence or permeability through time. For specific hypotheses see Hodder (1982) and McGuire (1982).

c. Assessments are needed of the extent to which current models for

interpreting variability among sites are adequate. For example, many small pueblo sites are routinely classified as "field houses", but it is possible that they represent habitation loci of very short duration. At the other end of the scale, very large Pueblo sites are assumed to have been long-term, year-round residences but the possibility of their seasonal use needs to be examined (Powell 1980). By virtue of their distinctive architecture or artifacts many sites are interpreted as representing migrant populations and/or new "cultures" (but see Toll et al.; 1980). In what way are these interpretations justified? What models do we need in order to support or refute such interpretations?

d. The distribution of sites across the landscape must to some extent be conditioned by the necessity to secure resources essential for maintaining a cultural system. At present, the distribution of sites in relation to resources--of the environment and other societies--is poorly understood.

We need baseline information on the distribution of natural resources. Current information maintained by the Forest Service should enable more informed mapping of biotic resources, agricultural land, and some mineral and lithic resources. This information should be used and additional information should be obtained.

e. Some sites exhibit rare or unique characteristics, which may provide information on the integration of regional systems at various scales. For example, we should examine the distributions of kivas, great kivas, tower kivas, large plaza areas, and the like. In addition to these highly visible remains are those that appear to have involved substantial investments of labor. We require ethnoarcheological data pertinent to understanding the labor and the time investments that went into the construction of such sites. Baseline data on the distribution of such features across the landscape are also needed.

f. Many of our best examples of prehistoric complex systems exist in areas that currently support low population densities. We need a better understanding of the productive technology used to support large population aggregates. Some studies, for example Vivian's (1974) discussion of water control features in Chaco Canyon and in the Southwest, indicate an elaboration and interconnectedness of water and soil control devices. Such complex systems need to be better documented through systematic studies of the properties and distributions of prehistoric agricultural features, as well as their mode of functioning. Information on the differential labor investments in planning, constructing, and maintaining such systems should be sought.

Experimental studies are required to understand the functional properties of these systems, their ability to enhance agricultural production, and their ability to prevent erosion. Ethnoarcheological and ethnographic information should be sought and systematized with respect to those attributes that are critical for the adequate functioning and maintenance of these systems (location, aspect, construction, slope, and soil type).

g. Very little is currently known about the composition, recruitment, organization, and longevity of task groups. The ethnographic literature of the Southwest is a beginning point for investigating these questions. Broader, cross-cultural information is also available and should be consulted for developing general models. At present, we do not fully understand variation in task group composition among societies at different levels of complexity.

5. Protohistoric and Ethnohistoric Periods

Archeological data relating to the protohistoric and ethnohistoric time periods provide substantive examples of many prehistoric situations we wish to explore. For example, population aggregation in the protohistoric period included the integration of diverse ethnic groups. Similarly, the amalgamation of Pueblo groups following 1680 also resulted in ethnically diverse aggregates. We also recognize the importance of this time period to current Native American inhabitants of the Southwest, and believe that research efforts should be devoted to exploring this important period.

a. For many years southwestern archeologists have made use of a limited and highly selected body of ethnohistoric

and historic documents. Efforts along these lines need to be greatly expanded to include a search for new documents (archives currently in Seville, Madrid, Mexico City, St. Louis, New Orleans, and elsewhere).

b. Ethnographic literature indicates that there are a variety of responses to the intrusion of foreign groups, particularly in a conquest situation. Such responses are in part related to the level of sociocultural integration of the societies in question. Research needs to be undertaken to (1) assess the organizational complexity of various Southwestern groups at the time of conquest, (2) assess the changes that may have occurred during the contact period, and (3) correlate these results with other cross-cultural data on contact situations (Upham 1982).

c. A unique resource related to this period is represented by the large refugee sites, many of which are found on the Santa Fe National Forest. These sites may serve as useful analogs for understanding a variety of processes, including the mechanisms by which disparate ethnic groups are integrated into single, large settlements, how such settlements were maintained under conditions of stress, and how labor was organized for constructing and maintaining these settlements. Study of archeological data should be combined with a thorough investigation of ethnohistoric documents of the appropriate time periods.

d. Both archival and archeological data relating to the construction of missions and churches in New Mexico can provide information on the time/labor investments needed to construct buildings on this scale. Such estimates may be useful when judiciously applied to prehistoric periods. These sources of data may also be useful in providing specific information about harvests per village, the amount of harvests and quantity of stored crops in villages, and the size of fields in use at various times. Again, when used with care this information may contribute to interpreting the prehistoric period.

e. Many of the standard ethnohistoric references contain little information on exchange. Archeological data on the protohistoric period, on the other hand, indicate widespread regional exchange. To resolve this apparent discrepancy, we can look at the refugee sites, reanalyze extant archeological data from protohistoric sites, and build models of the functions of regional systems during the ethnohistoric period.

f. We need better models for predicting how the development of ethnic identity was influenced by the presence of a foreign political and social order. Specifically, the delineation of Navajo as opposed to Apache seems to have resulted from Spanish administrative policy. Were these policies and their implementation also relevant to the formation of relatively more sedentary peoples, such as the various Pueblos? Again, cross-cultural information on contact/conquest situations should be explored.

g. A number of archeological arguments about cultural change depend heavily on realistic population estimates. For the protohistoric and historic periods, estimates of population have been computed from a variety of sources using a variety of formulas with disparate results. We need to reevaluate the adequacy of our methods for estimating populations at this and other time periods. Perhaps there is a role for archeological data to play in firming up population estimates for protohistoric and historic times.

TOPIC B: ENVIRONMENTAL CHANGE

It is within the context of human-environment interactions that archeology has the greatest potential to contribute to the convergent interests of land management, prehistory, cultural evolution, and land use planning for the future. Archeologists potentially control large amounts of data, sometimes spanning many millennia, that relate directly to changing environments and changing societies. The Southwest is particularly appropriate for these sorts of studies because the archeological data indicate repeated societal failures through time, despite sophisticated environmental knowledge and technological innovations. A record of man-land relationships on New Mexico Forests spanning at least 10,000 years is available for study. The prevalent view of the Southwest as a "marginal" environment, particularly for agricultural adaptations, may largely be conditioned by our perceptions of current conditions. For

these reasons, the continued study of paleoenvironments and the refinement of paleoenvironmental reconstructions are a high priority.

At present several kinds of primary paleoenvironmental evidence are generally sought in the context of archeological research (e.g., pollen, macroflora, fauna, treering, and geomorphology). Frequently the data obtained from these analyses lead to conflicting interpretations of the past environment at the time of deposition. A high priority must be placed on developing methods to understand the causes of these discrepancies in order to build more comprehensive models of past environments. Chronological refinements are needed to check the pace of climatic change and to tie climatic events to the modern calendar. The following are offered as a sample of potential studies.

1. Continuing studies of sedimentology, hydrology, geomorphology, and palynology are essential. We need to develop improved methods for separating cultural from noncultural factors influencing the evidence of past environmental conditions. Specifically, studies should be undertaken on "pristine" settings, that is, closed drainage systems, such as bogs, and lake sediments. Continuing research on the processes of alluviation and degradation need to be undertaken in diverse localities. Documentary sources that chronicle stream course change and other major hydrologic and/or geomorphic events need to be consulted. Results of these studies should be integrated regionally to provide a synthetic model of paleoenvironments through time. Forest Service Research Natural Areas are probably crucial to this endeavor.

2. A number of innovative approaches to the study of paleoclimate involve techniques that have yet to be perfected. Such studies show great promise for providing archeologists with data that are now unobtainable from other contexts. Specifically, studies of pack-rat middens (Van Devender and Spaulding 1979) and plant opal phytoliths (Rovner 1983) need further research and development. One of the drawbacks to earlier pack-rat midden analyses has been a neglect of probabilistic sampling procedures. Seemingly subjective choices have governed the selection of samples that are collected and analyzed. New studies are needed that employ probabilistic sampling procedures to assess the reliability of pack-rat middens as bases for refined paleoenvironmental reconstructions. Another line of study that shows promise has been research on opal phytoliths. Because of their durable nature, phytoliths can be expected in many contexts and may provide information on plants that is otherwise unobtainable. Unlike pollen, phytoliths are not dependent on dispersal mechanisms. Consequently, they should be ubiquitious and should reflect directly the composition of local plant communities. Basic research is needed on taxonomy of phytoliths of Southwestern plants. The use of phytolith analysis to resolve paleoenvironments at a fine scale is an important research need in the Southwest.

3. It is often assumed that climatic change is exclusively a long-term phenomenon, but this is not necessarily true. Many non-traditional sources of information can be used to address this issue. For example, photographs of many areas of the forests exist in archives and can be consulted to evaluate changes in climatic and environmental conditions over at least the last five decades. Often the same location is represented in a series of photographs taken at varying intervals. Those that have been examined show remarkable changes in conditions of the natural environment, and in some cases these changes are counter-intuitive. (Early photographs showing badly eroded landscape followed by natural reforestation in several decades). Research should be undertaken to assess fully the quality of this archival resource and to make available inventories of these basic data. Investigators should not overlook the many photographs owned by private institutions and individuals. In addition, the accounts of early travelers, military documents, Franciscan missionary records and other textual information should be combed for environmental information.

4. Archeological sites have the potential to provide information on the species diversity of local areas, if carefully interpreted. These data can be obtained routinely in the course of testing and data recovery projects, but are rarely subjected to the full range of possible analyses. For example, wood used in

construction and fuel, as well as annual plants used for a variety of purposes, can be identified to the species level in many cases. If these data were systematically evaluated on a regional basis it would be possible to map the distribution of species that grew in the past, taking into account the cultural filter. Optimally, maps could be created to show the distribution of these species through time.

5. The formation processes that create environmental evidence have not been systematically investigated. For example, pollen from archeological contexts is employed routinely for paleoenvironmental reconstruction without regard for cultural contamination or even differential preservation of pollen in such contexts (Bryant and Holloway 1983). Research is needed to determine the cultural impacts on the pollen record. All other lines of evidence are similarly in need of reevaluation in terms of formation processes.

Another important issue pertains to adequate sampling procedures. A recent study of pollen deposition within a single room in Chaco Canyon demonstrated vastly different pollen spectra obtained from different parts of the same floor. This study also disclosed the rapid contamination of open contexts (Cully 1979). Clearly, many more such studies are needed.

6. Although seemingly very specific, rockshelter deposits provide a rich source of paleoenvironmental data for archeologists. However, the ways in which human presence affects the formation of deposits in rockshelters are not well understood and need further examination if meaningful interpretations are to be derived from such deposits (Wills 1981). For example, the cultural practice of storing foodstuffs in caves may encourage the activities of pack-rats and other rodents. The extent of rodent activity has substantial implications for interpretations of archeological data from cave loci. The recent example of the extent of pack-rat disturbance in the interpretation of Bat Cave deposits should be a lesson (Wills 1981). In addition, Wills suggests that the simple introduction of carbon dioxide into cave environments by the presence of people may have important implications for the formation of cave floor sediments.

TOPIC C: ABANDONMENT AND DEPOPULATION

Collapse

In many regions throughout the world, developmental patterns are punctuated by episodes that are labeled "collapse" or "abandonment." These episodes are of importance to all general discussions of cultural evolution and are the focus of considerable recent research (Yoffee 1982). The southwestern data highlight the problem of grouping "collapse" and "abandonment" as necessary manifestations of the same underlying set of conditions. It is necessary to distinguish between instances of regional political disintegration and instances of depopulation and to develop theoretical and methodological approaches for understanding each. In the Southwest, the abandonment of regions (and localities) is a recurrent culture historical theme.

The abandonment of some regions has implications for the complementary redistribution of populations, unless there was also catastrophic population decline. In the absence of evidence of massive die-offs, various migrations, migration routes, and "ethnic" origin models have been postulated to account for shifts in population distribution. Very few of these are supported by available data and conflicts over interpretations of the data abound (Ford, Schroeder, and Peckham 1972). This indicates that a reevaluation of evidence for migrations, migration routes and "ethnic markers" must be undertaken. Much of the literature assumes that the causes of "collapse" are environmental changes. Such assumptions also falter on a lack of concrete data.

Another issue related to the notions of abandonment and collapse involves our perceptions of adaptive diversity in the Southwest. By adaptive diversity we refer to the characteristics of populations at different levels of energy exploitation and complexity, which incidentally but importantly, leave records of their behavior having different levels of archeological visibility. There is no reason to preclude the possibility that some "collapses" may represent people returning to mobile subsistence strategies or adopting these kinds of strategies anew (Upham in press). The large number of "unidentifiable" sites in

the Southwest may represent such changes. The following research questions provide a framework for developing productive approaches to resolving these issues.

1. The Southwestern data are appropriate for evaluating general anthropological discussions of "collapse" and "abandonment." Some of the frequently cited causes may be found in the summary chapters of the Maya Collapse volume (Culbert 1973; see also Willey and Shimkin 1973). Many of these models can be evaluated critically using southwestern data; research needs to continue along these lines.

2. One problem hindering resolution of the abandonment issue has been our inability to identify the remains of groups at lower levels of social complexity. The low visibility of some groups (e.g., Yavapai, Apache, and Navajo) is a continuing problem. This results in part from the high mobility of these groups, and their small material culture inventory. These problems are compounded by their use of forested environments where discovery of their remains through survey is difficult at best. We need to develop methods which allow us to find and discriminate the remains of such groups.

3. We need to develop better methods to evaluate population changes through time in the Southwest. Clearly, the application of fine chronological techniques is a prerequisite to this issue.

4. Because migration is claimed as a common consequence of abandonment, cross-cultural research needs to be undertaken to determine the conditions under which migrations actually occur. Society-level migrations, such as those postulated following abandonments in the northern Southwest, are a relatively rare phenomenon (Adams et al. 1978). Small scale or local migrations are far more common. We should continue to look for complementary patterns of population decline and growth between regions and localities (S. Plog 1969).

5. The collapse of regional political systems may entail the loss of highly visible boundary maintaining devices. The cessation of production of Chacoan ceramics is an example. The disappearance of these markers may give the appearance of dramatic population decline since, in the Southwest, sherds are frequently equated with people.

Research needs to be undertaken on the material correlates of cultural boundaries and on the causes of change in boundaries and in boundary maintenance mechanisms (McGuire 1982). In addition, we again emphasize the need to refine chronology, and to solve the problems of unidentifiable sites. We suggest that cross-cultural and ethnoarcheological approaches to these questions will prove valuable.

6. Among the traditional explanations for abandonment are the supposed intrusions of foreign groups, disease, and internecine warfare. Southwestern skeletal populations are an important and extensive resource for studying paleodemography and biological relationships between and among settlements, and are essential for investigations of paleopathology. We encourage the continued development and application of methods of assessing homogeneity and heterogeneity within skeletal populations. If migrations were a consequence of abandonment, one might expect genetically diverse populations to occur in post-abandonment sites. We encourage the use of existing museum collections in addressing these suggested causes of abandonment. In considering disease as a cause of abandonment, we should not forget that large settlements produce increasingly complicated sanitary requirements.

7. Again, studies of the agricultural technology used to sustain large settlements should continue. Specifically, efforts must be made to identify problems of mineralization, soil nutrient depletion, and erosion. Field recovery rates in different environmental settings need to be developed, as do recovery rates for other economic resources (e.g., fuelwood).

8. In pursuing various possible internal, systemic models of collapse, we need to consider the utility of considering "collapse" as part of the normal developmental trajectory of many complex systems. To what extent was the prehistoric situation in the Southwest an example of overextension of energy extraction strategies? Are there life spans to particular developmental trajectories and, if so, what are they and what are their lengths? What are

the internal dynamics that create apparently recognizable stages in the development of societies?

History of Land Use

To study the history of land use presupposes adequate paleoenvironmental reconstructions, and these two questions are interrelated. However, the specific intent of this topic is to examine the history of cultural impact on the natural environment. The Southwest's environments are generally characterized by their fragility (e.g., slow regeneration rates in vegetational succession, soil depletion, erosion, and mineralization). As a result, the impact of cultural activities on the landscape is readily observable and can be studied to enhance our understanding of the effects of past practices. Based on such understanding we can assess the potential future effects of modern land modifying activities.

The wise management of resources is of critical importance, and archeology--with its perspective on long-term change--can provide land managers with data useful for land-use planning. For example, work conducted in the Socorro area in 1981 (Earls 1982) demonstrated that the invasion of the presently dominant creosote community postdates 1500. This and other studies suggest that the environments we observe today may be very different from those inhabited by prehistoric populations. This in turn indicates that the causes of some vegetational shifts may be modern human activity (e.g., overgrazing, drop in the water table due to excessive pumping of ground water supplies, and deforestation). On the other hand, the beneficial results of the Forest Service policy of multiple land-use management is also clearly observable in the regeneration of forests in the 20th century. The intent of this research topic is to stimulate investigations into the nature of human-land relationships, emphasizing the effects of cultural activities on the land. The following avenues of research are proposed.

1. Forest Service files contain a vast, untapped reservoir of historical documentary materials, particularly photographs, pertaining to changes in the vegetation of local landscapes. This material is scattered in various locations, including Ranger District, Supervisors' Offices, and central repositories. There is a need to systematically search for and catalog these materials. Research should result in an inventory of available documents providing a record of environmental effects in the context of varying management practices.

2. In addition to the catalog of historic materials, the development of simulation models of land-use history should be undertaken in order to illuminate the effects of varying land-use practices such as timber harvesting, and grazing, on the forests. These activities, which appear to affect different environments differentially, also have implications for the presence and visibility of archeological remains. Experimental approaches are needed to study the effects of specific present day activities as well as those that might have taken place in the past.

3. It is important to understand the resilience and evolutionary trajectories of modern biotic communities and species, considering the likelihood that these may have been affected by human activities. For example, the possibility exists that the change from *Bison antiquus* to *Bison bison* was a consequence of human predation (Frison 1978), and should be examined. We may expect, on the basis of our understanding of biological evolution and community ecology, that the introduction of a "new" species has consequences for existing species. These consequences need not be so drastic as those in Martin's (1973) overkill model of Pleistocene extinctions, but they may involve changes in species behavior and morphology as suggested in the *antiquus* to *bison* comparison.

In order to approach this question, contemporary data on game management, compiled by the Forest Service, should be examined. For example, records of the effects of bow hunting on mule deer populations have been kept and are available for study. More general cultural practices, like agriculture, can also have substantial impacts on the environment and studies of these need to be consulted or carried out. Specifically, data suggest that agricultural fields provide prime habitats for some species of animals and many species of plants. Disturbed land surfaces, which are a concomitant of cultivation, encourage the

invasion of many weedy species, some of which have economic value. Few studies have been done to determine what, if any, impact such plants may have had on subsistence practices in the past. Similarly, few studies have been done to determine the effects of these weedy species on the overall composition of the biotic community.

4. Some species of animals which were very important in the diets of prehistoric populations have rather limited distributions today. Research is needed to determine the prehistoric distributions of animal species, their behavior and reproduction rates, and how these may have been affected by cultural activities. For example, mountain sheep are nearly ubiquitous in the archeological record of Pueblo times, yet today these animals are extremely scarce. Similarly, bison have been found in archeological contexts far to the west of their extrapolated ranges (e.g., as far west as eastern Arizona). The destruction of antelope herds--abundant in the early historic period--may relate to the destruction of their habitats. We also need to understand the effects of modern impacts on faunal and floral species to determine if some contemporary practices are appropriate analogs for past behavior.

5. A number of questions involve the long- and short-term changes resulting from agricultural practices. Investigations are needed to document possible mineralization and salinization of prehistoric agricultural fields. These studies must include areas where such changes are not usually expected. For example, studies such as the one by Fosberg and Husler (1979), demonstrate substantial mineralization in a prehistoric field in the Cochiti area of the Rio Grande Valley. Similarly, "arroyo cutting" which has been implicated as a major cause of culture change in the past (from the development of soil and water control features to the abandonment of regions) appears today to be caused by cultural activities, although in archeological interpretations it is nearly always attributed to climatic change. Clarification of the causes and effects of arroyo cutting is needed (Love 1980).

The crops planted in the Southwest prehistorically included varieties, such as corn, that have high nutrient requirements and may have had long-term effects in depleting local soils. Little information exists on the nutrient requirements of the other prehistoric cultigens (e.g., squash, beans, and cotton) as these relate to the local soil types available in the Southwest. The possibility exists that specific plant requirements provided a basis for agricultural specialization in prehistoric times. In many areas where large populations existed the amount of available arable land is extremely limited. Other areas where populations were apparently smaller, not only have large amounts of arable land but also show evidence of extensive and sophisticated soil and water control features. How extensive was soil depletion? Is it possible that local soil depletion caused some areas to become specialized in the growing and exchange of particular foodstuffs? Were local problems of soil depletion in some way responsible for major regional population shifts?

6. Although it is generally assumed that prehistoric impacts on the environment were minimal, land-clearing activities for house construction, for agricultural fields, and for obtaining firewood may have had broader and more long-term effects on forests and woodlands. Systematic examination of these relationships is required and might entail simulation modeling of wood use and forest regeneration rates, and the use of ethnographic and ethnohistoric data to examine fuelwood consumption rates.

These studies should, of course, be related to the archeological collections and identification of fuelwood species.

CROSS-CUTTING RESEARCH NEEDS

Archeological Chronology

One of the most persistent obstacles to processual studies continues to be our inability to date precisely past cultural events, such as the manufacturing span of pottery types, the founding and abandonment of settlements, and the emergence at various scales of regional systems. Moreover, without sound chronological frameworks, it is nearly impossible to conduct refined studies on rates of change in behavior and organization, or to correlate changes in cultural phenomena with changes in environmental conditions. For

example, recent work on the Colorado Plateaus (Euler et al. 1979) has suggested that phase boundaries represent cultural changes that may have been the result of contemporaneous environmental changes. While we applaud the attempt to synthesize cultural and environmental data and encourage further testing of propositions generated by work on this scale, there is currently no way to evaluate the validity of the proposed correlations because the chronologies are far less precise than is needed.

Other chronological problems include limited samples of tree-ring dates, few if any precisely tree-ring dated pottery types, and limited applications of other chronometric techniques (C-14, archaeomagnetic dating, obsidian hydration, thermoluminescence) as well as our inability to date most classes of artifacts directly. These are among the obstacles that must be overcome in future chronological research (Schiffer 1982). Because of these problems, all chronometric techniques require further development.

The following are among the possible topics for future research.

1. Reevaluation of all dating techniques, as they pertain to the kinds of cultural materials found on archeological sites in New Mexico forests.

2. Development of techniques appropriate for the direct dating of artifacts and ecofacts, particularly those making use of C-14 accelerator technology.

a. Dating of carbon paint on ceramics.

b. Dating of carbon on smudged pottery.

c. Dating of the carbon streak in some pottery types.

d. Dating of the organic constituents of adobe, plaster, mortar, and living surfaces.

e. Dating bone collagen.

f. Dating the conchiolin fraction of shell.

g. Dating the carbon content of opal phytoliths and small macrofloral materials.

h. Dating the organic content of desert varnish on lithic artifacts and on some petroglyphs.

3. In order to make the best use of chronometric information, we must develop better techniques for identifying the formation processes of deposits from which chronometrically dated materials are taken (Schiffer 1976). For example, a piece of charcoal found in trash in a pueblo room does not provide the same information as a roof beam with respect to dating the events of room construction and maintenance (Dean 1978).

4. Where possible it is preferable to apply radiocarbon dating to the remains of annual plants rather than to chunks of wood and unidentifiable charcoal (Schiffer 1982). It is now possible using larger counters to obtain radiocarbon dates of high precision (±25 years in some cases). To take advantage of this development, archeologists need to submit larger samples of annual plants, at least 10 grams. More research is needed on the disparities between dates on annual plants and dates on wood from trees and/or perennial shrubs. A fruitful approach to this problem may be the radiocarbon (and in some cases tree-ring dating) of dead wood found on the surface in forests (Schiffer 1982).

5. Studies should be undertaken to determine the average age of "old wood" found on the surface of forests. We expect some differences in the age of such wood depending on the location, elevation, present and past vegetative cover, land-use patterns, and mix of species.

6. Continued research is needed to refine existing archaeomagnetic curves and, especially, to develop curves for periods prior to A.D. 600 (Eighmy et al. 1980). This will involve submitting independently datable materials (C-14, tree-ring) from contexts where archaeomagnetic samples have been taken. Most published archaeomagnetic dates in the southwest are devoid of important information needed for recalculating dates as the curves are refined. Archaeomagnetic specialists now agree on the basic

geomagnetic data that need to be included; the Forest Service should insist that all dates from its sites be reported in full.

7. Studies need to be undertaken to determine the effects of forest fires and fire management on materials submitted for chronometric analyses, especially materials dated by obsidian hydration and archaeomagnetism.

8. There is a need for the development of local obsidian hydration rates for all areas of the Southwest. To develop such rates, source studies will be necessary to characterize the range of variation of particular obsidian flows (Michels and Tsong 1980). In addition, it will be necessary to undertake correlations of various source materials and artifacts. In some cases, provenienced museum collections may contribute to such research.

9. A thorough reevaluation is necessary to determine the number of "well-dated" sites in the Southwest. Many archeologists operate under the misconception that large numbers of tree-ring dates from a site are sufficient to resolve dating problems. Recent studies (Ahlstrom, in preparation) have shown that the occupation span and growth patterns of sites having large numbers of tree-ring dates are not necessarily well understood. One can expect that we know a great deal less about sites having fewer dates.

10. Studies should be undertaken to determine if thermoluminescent dating is a useful dating tool in the American Southwest. Pilot studies in other areas have indicated that materials other than ceramics, such as sandstone and heat-treated cherts, may be amendable to thermoluminesent dating.

11. Studies need to be undertaken to determine the use-life of particular artifact categories. Ethnoarcheological research in several societies has shown that cooking vessels in everday use have a use-life of about 6 months to about 2 years, but we would not expect all functional categories of ceramic vessels to have comparable use-lives.

12. An evaluation is needed of current extant seriation, microseriation, and cross-dating techniques. Approaches to this question must necessarily rely on the use of chronometric methods to assess the efficacy of the relative techniques.

Unidentifiable Sites

A great many sites that archeologists routinely record in the course of site survey are classified as "unidentifiable." This corpus of sites may represent important components of the prehistoric cultural systems archeologists wish to understand. Additionally, they may represent hitherto unknown cultural groups or sequences. In some cases, unidentifiable sites represent over 50 percent of all recorded sites in an area (see Table 1). Until we have a better way of accurately determining the affiliation (cultural, functional, and temporal) of these sites, our understanding of southwestern prehistory is restricted--if not in error. Clearly, approaching these sites in a systematic research fashion is of major importance in the Southwest and to the discipline of archeology. The following possible avenues of research are proposed:

1. It is critical that all available chronometric techniques of demonstrable utility be applied to these sites.

Table 1. Percentages of Sites of Unknown Cultural Affiliation on New Mexico Forests.

Forest	# of Sites	# of Unknown Sites	% Unknown
Carson	399	355	89
Cibola	1,047	808	77
Gila	1,329	617	46
Lincoln	253	157	62
Santa Fe	3,114	274	8
TOTALS	6,142	2,211	36

2. Current Forest Service site files contain locational information of sufficient specificity to permit the plotting of unidentified sites on maps of the landscape. The distributions of these sites with respect to each other, to various landforms, and to vegetation zones may be useful in attempts to identify their temporal periods, cultural affiliations, and functions.

3. Recent models (Upham in press) suggest that at least a portion of the unidentifiable sites may pertain to mobile groups identified by the Spanish (Apache, Manso, Navajo). In addition, some of these sites may represent activity areas of more sedentary groups who are better documented archeologically (e.g., Zuni, Jemez, and Taos). Studies should be undertaken to map the territories occupied and used by groups of known cultural affiliation, as a basis for recognizing diagnostic attributes which would aid in relating unidentified sites to known adaptive patterns.

4. Studies of Hispanic villages in New Mexico (Snow 1981) show that within this relatively homogeneous ethnic setting, some artifact classes are locally manufactured whereas others were obtained from diverse Native American communities. Historic and ethnohistoric documents should be consulted in order to learn which cultural groups are involved in the manufacture and exchange of objects that are potentially identifiable archeologically, and the economic and political conditions under which trade in utilitarian items occurs among diverse cultural groups. Models derived from these studies may aid in determining the cultural affiliations of unidentifiable sites' having artifact compositions that are either relatively homogeneous or heterogeneous in regard to the origins of artifacts.

5. Many studies have suggested that quantitative differences exist between the lithic assemblages of Archaic and Puebloan sites. These differences result directly from lithic reduction strategies, e.g. biface manufacture. Studies need to be undertaken to determine whether such differences are real and can be consistently identified archeologically. Preliminary evaluation of these studies can be undertaken on existing collections in museums. Results of such research can be applied to the interpretation of the debris in unidentifiable sites. This may be one way to approach the problem of identifying low visibility Archaic and Puebloan sites.

Artifact Studies

In much of the foregoing we have emphasized the need to develop better and more appropriate principles for archeological interpretations. Experimental studies of artifact manufacture and deposition are key to the development of these methodological principles. Here we examine several approaches that might be productively pursued in the Southwest. We encourage further innovations along these lines.

1. We must continue to direct research toward defining the distribution of sources of such material as obsidian, clay, cherts, turquoise, shell, copper, and various tempers. We recognize that some material sources are heterogeneous in composition and hence recommend that studies be developed in collaboration with geologists. With geological consultation, appropriate sampling strategies should be developed to collect source material for each element and other data. These should be compared with existing artifact collections housed in museums. An integral part of these investigations must be the continued refinement of chemical source analysis techniques, especially those using multivariate analyses to distinguish among postulated provenances. Experiments should be conducted to replicate prehistoric mining techniques, in conjunction with analyses of archeological collections from prehistoric mines and information from ethnohistoric sources.

2. Our discussions of productive specialization indicate that we must learn to identify manufacturing loci, particularly ceramic firing areas. We recommend systematic excavation and testing in extramural locations of settlements and further work in identifying kiln debris and wasters. We need to continue experimental methods (replication studies) to evaluate the lithic reduction models currently being used to distinguish sedentary from mobile populations. (See also our discussion above on the need to study ceramic breakage and replacement rates.)

3. Archeologists often assume that a

particular class of vessel functioned in a specific context (e.g., Mimbres bowls as only mortuary offerings), but there is little demonstrable basis for these assumptions. We need to evaluate the technological properties of particular ceramic classes (e.g., do corrugated vessels retain or transfer heat unusually well, do various tempering materials influence porosity--or does temper function primarily to aid in the manufacture process?).

4. We encourage experimentation in the planting of various native crops and using various techniques of field maintenance. In the same vein we need measures of the labor investment involved in harvesting and processing various food resources, as in Doelle's (1976, 1980) studies on the Papagueria. We also need to investigate the caloric and nutritive content of various wild plant foods, their transportability, and the periods of time over which they may be stored. Experimentation should also be conducted to enable quantification of the increase in productivity possible by tending various wild plant resources. We expect that ethnoarcheological studies that examine these areas will also be beneficial.

Formation Processes

Throughout the above discussions we have stressed from time to time the need to identify and take into account the formation processes of archeological materials. We reiterate here that such studies form an integral part of all archeological research and underlie all archeological interpretations (Schiffer 1976; Sullivan 1978). We place a high priority on experimental studies that will help us to understand and identify archeologically various formation processes (Rathje and Schiffer 1982).

The following suggestions are offered for studying formation processes during archeological data recovery and analysis.

1. The intensive analysis of survey data-particularly assemblages of surface-collected artifacts--is the basic procedure for studying regional land-use patterns and subsistence-settlement systems. The usual approach is for the archaeologist to control temporal parameters by means of seriation, then, within temporal periods, to attribute the remaining inter-site variation to differences in settlement function. Studies are needed to investigate the contribution of a host formation processes to the observed inter-assemblage variability that is now routinely--and perhaps incorrectly--assigned either a temporal or functional cause. We propose that work begin on the following questions. To what extent can differences in the occupation spans of settlements having similar functions create differences in assemblages? Do patterns of multicomponentcy bias the record of particular occupations? Ethnoarcheological and simulation studies as well as careful and critical analyses of extant survey collections might shed light on these questions. Holding constant basic artifact parameters (e.g., quantity and diversity), to what degree do differences in the sample sizes of surface collections produce assemblage variability? Simulation studies and analyses of extant collections offer the greatest promise to answer this question. Have past land-use practices and environmental processes introduced variability into surface assemblages? This question can best be approached by modeling the likely processes on sites of varying characteristics. We especially encourage investigators to grapple creatively with the contributions of formation processes to interassemblage variability of surface collections whenever analysis of regional data is undertaken.

2. Inferences of many kinds are based on the assumption that the sites recorded by intensive surveys adequately represent the variability extant in the archeological resource base. However, a host of factors relative to formation processes affect the conduct and results of archeological surveys. We propose that experiments be undertaken to improve site discovery, especially in National Forests, where visibility is often impaired by vegetation. Results obtained by using techniques, such as periodic shovel testing, should be compared with intensive pedestrian surveys of the same area. Geomorphological information should be used to predict where within various study areas there is potential for buried sites to be found. In areas of the United States where such modeling has been followed up with backhoe testing, sites were discovered that appreciably altered extant perceptions of the resource base. It is simply unrealistic to assume that when applied to any environment, pedestrian

tactics supply comparable data on the occurrence of sites.

3. A variety of land uses are currently permitted on National Forests, some of which may be significantly degrading the archeological resource base. Additional studies--experimental, ethnoarcheological, and theoretical--are needed on the effects of specific land uses, such as grazing, logging, and juniper chaining, on particular kinds of archeological materials and resources. With upgraded information on impacts, forest archeologists will be in a much better position to make recommendations.

4. Intensive study is needed of the formation processes that generally contribute to variability in sherd frequencies? Clearly, experiments on ceramic breakage and trampling are needed. Frequences of macrofloral remains, pollen, and animal bones are especially problematic because these lines of evidence are degraded and augmented by environmental formation processes. Because these "ecofacts" are used for making inferences about cultural behavior and past environmental conditions, it is essential that investigations be undertaken of diverse formation processes so that their effects can be sorted out in given cases. Experimentation, ethnoarcheology, and judicious analysis of extant archeological data will contribute to this effort.

5. Lines of evidence, such as chipped stone and faunal remains, usually occur together in packages we call "deposits." These entities, such as the fill of pits or the artifacts resting on a pithouse floor, are themselves peculiar artifacts, the properties of which reflect their genesis. By studying those attributes of artifacts and characteristics of deposits that indicate formation processes, it becomes possible to gain a better appreciation for the information potential of given deposits. The highest priority at present is to carry out research on the formation processes of the kinds of deposits, such as floors and fills of pueblos and pithouses, that most frequently supply evidence for inferences on subsistence, social organization, trade and other important systemic properties of societies. Experiments with more fine-grained recovery techniques, including microstratigraphy and special techniques for sampling of very small artifacts (e.g., microdebitage) are clearly indicated. Data presented in published reports may furnish hypotheses about formation processes that can be tested in future fieldwork. Museum collections can also supply information on the formation processes of deposits, but they must be studied in new ways, using characteristics such as artifact size classes, degrees of ceramic vessel restorability, and artifact damage patterns.

By investigating the formation processes of particular lines of evidence and of various types of deposits, we will be laying a foundation for solving high-level research problems rigorously.

IMPLEMENTING RESEARCH AND DEVELOPMENT TOPICS

In the course of presenting what we consider to be the most important research issues to be addressed in the near future by those conducting research on Forest Service land in New Mexico, we run the risk of being accused of having set unrealistically high research goals. We fully recognize that most of the issues we have raised will have to be addressed by many individuals, working in diverse research environments, over the course of a number of years. Some of the research questions we have identified will most appropriately be pursued in the normal course of academic research in college and university settings. Other questions are best approached by Forest Service personnel in conjunction with their management and management-related tasks. Still others will be examined by contractors and permittees in the context of their work on Forest Service lands. We hope that much of the research will be of a collaborative nature.

We recognize that the cost both in dollars and in human labor for quality research of the kind needed is high. We expect that the funds to adequately address these important research questions will come from diverse sources such as federal granting institutions, survey and data recovery contracts, agency research and development funds, and academic institutions. Here we will only identify some of the most obvious areas of inquiry in which we envision direct contributions by the Forest Service.

Many of our research questions dealing with

basic chronology can be moved toward effective resolution with data readily available from the Forest Service, for example, the studies of the effects of fire and fire management on archeomagnetic samples, and the collection and analysis (radiocarbon and tree-ring dating) of usable dead wood found in forests. A number of our questions generate the need for accurate baseline maps showing spatial distributions of unidentifiable sites, of large and/or unusual sites (e.g., great kivas), of agricultural features with respect to landforms, present biotic communities, and of important geological source materials. In addition, Forest Service and Department of Agriculture information on wild crop production, regeneration rates of woodland and forest environments, hydrological models and the effects of various kinds of predation on wildlife are useful to many of the issues we have raised. We are especially interested in the research potential of Forest Service documents and photographic archives that relate to the history of land-use management. Because these materials are widely scattered, we believe that adequate funding for the preparation of catalog(s) will be money well spent. The Forest Service and Department of Agriculture are in a position to provide information needed to evaluate the productivity of different varieties of domesticates and of native wild plants.

Various experimental activities that we have proposed might be accomplished on National Forest land in conjunction with on-going Forest Service programs, to their mutual benefit. For example, historic buildings in wilderness areas can be examined and studied in the course of their disintegration, allowing archeologists to monitor the use-lives of various construction materials and providing managers with realistic information regarding the length of time necessary to return landscapes to their "pristine" condition. In addition, we believe that constructing some agricultural features, planting native crops, and monitoring labor inputs and harvests might be incoprorated within the Youth Conservation Corps (YCC) summer programs to enhance the educational content of these worthwhile experiences. Another obvious direction that can be taken by the Forest Service is the evaluation of the effects of various land-use strategies on archeological sites.

In addition to these projects, continued cooperation among the various branches of the Forest Service will provide information that is essential to achieving the general goals outlined above. For example, range management information on the nutritive requirements of various wild plants should be expanded to include plants that were used by the prehistoric populations. Evaluations of soil chemistry in the forests should be expanded to include elements important to Native American subsistence crops. Range management can also provide detailed information regarding the erosion potential of various landscapes and soil types. These data should also include studies on mineralization and soil depletion resulting from aboriginal agricultural practices. This kind of information, although it is critical to archeology, can also provide a more realistic baseline for determining the long-term effects of various uses of soils that might be considered to be in their "pristine" form.

We wish to emphasize the mutually beneficial aspect of investigating the record of the past. Archeology provides information on the past lifeways of our region which is of interest to its indigenous population, as well as its current residents and visitors. But this is also a record of human experimentation in complex and relatively fragile environments that has implications for our understanding of the general course of evolutionary change in human societies and provides information that is valuable to our present and planned uses of resources on the National Forests.

SITE ALLOCATION GUIDELINES FOR NEW MEXICO FORESTS

Patricia M. Spoerl and Joseph A. Tainter

INTRODUCTION

Field research into the Forest Research Topics outlined in the preceding chapter represents one major potential use of the prehistoric cultural resources of the New Mexico Forests. Archeological sites which are suitable for addressing these research topics should be managed by the Forest Service to maintain the qualities that make them useful for study. At the same time, though, many sites are suitable for purposes other than research, indeed may be best used for other purposes. How may New Mexico Forest managers reach decisions about suitable uses for sites, and plan subsequent management strategies? In other words, how should sites be allocated? In this chapter we develop guidelines to accomplish this according to standarized, replicable criteria. Decisions concerning allocation are made on the basis of information about each site recorded on the Southwestern Region's "Archeological and Historical Site Inventory" form (R3-2300-2). The following allocation scheme is, of necessity, tied directly to the information categories recognized by this form.

Allocation is the process by which decisions are made concerning the types of management and research cultural resources should receive. The allocation scheme developed below utilizes a hierarchical decision tree (Figures 1 through 8) to assign sites to a series of allocation categories. The decision tree has been formulated to provide a standard sorting procedure and allocation strategy applicable to each forest in the state. Both computer manipulation of site data from the Region 3 site survey forms and professional judgment on the part of Forest Archeologists are used in the allocation process.

This chapter is divided into two parts. The first outlines the overall allocation process for archeological sites in terms of the decision tree (Decision Tree Step 1). The second part presents a second decision tree (Decision Tree Step 2) by which sites relevant to the solution of the research topics outlined in the first chapter are assigned to a particular topic(s).

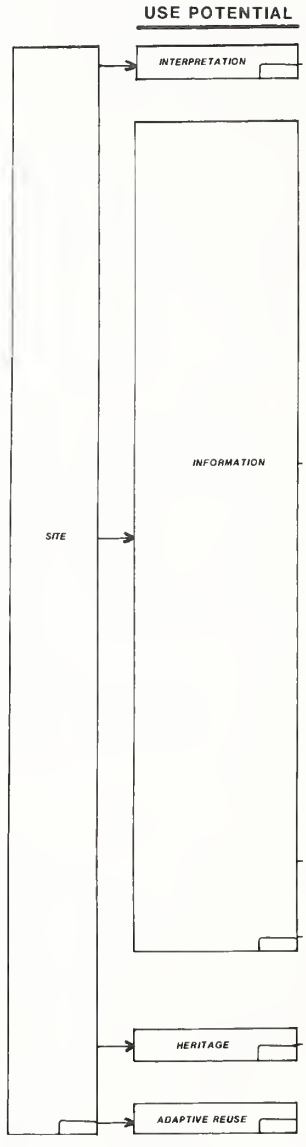

Figure 1. Decision Tree Step 1, Node 1--Use Potential

DECISION TREE STEP 1

Our general scheme approaches the allocation of cultural resources as a hierarchical decision tree. This decision tree has seven nodes: Use Potential, Site Condition, Site Use, Site Size, Allocation 1, Allocation 2, and Allocation 3. Each of

these categories is discussed separately in the following sections. In order to gain a complete understanding of the actual allocation process the reader must refer to the decision tree when reading these sections.

Use Potential

This attribute (Fig. 1) underlies the first dividing node of the hierarchy. It serves to differentiate sites on the basis of the four major uses likely to be made of them: (1) interpretation, (2) information, (3) heritage, and (4) adaptive reuse. It should be pointed out that the major uses that may be made of a site are not necessarily the only ones that can be made. As an example, some sites with information potential may be used primarily for public interpretation, based upon whether they contain properties useful for visual display and are accessible. These sites may also be used for scientific research, but are not managed primarily for that purpose. Hence, such sites are separated early in the decision hierarchy.

The use potential categories are defined as follows:

Interpretation. Sites allocated for interpretive use are those used principally for a public demonstration of their values. Such sites may also be used for scientific research, but are not managed primarily for that purpose.

Information. Sites allocated for information use are those considered primarily useful for addressing questions of scientific interest. Information use is subdivided into four categories. These categories are defined below but are included in the decision tree at later steps.

1. Preservation. Sites are removed from immediate use and are managed to prevent deterioration or loss of values.

2. Conservation. Sites are protected from deterioration or loss, and are managed for best use. Conservation use is of two types:

(a) Conservation Research sites are those relevant to the research topics discussed elsewhere in this document.

(b) Conservation Pool sites are those managed for potential future use.

3. Experimental. Sites allocated to experimental uses are those appropriate for the evaluation of impacts of surface disturbing activities and other environmental effects on information (research or interpretation), heritage, or continuing use/reuse values.

4. Removed from Management Consideration. Sites removed from further consideration are those determined through professional evaluation to not possess information potential.

Heritage. Sites allocated to heritage use are those important to the values or beliefs of distinguishable groups. Such groups may often be ethnic in character, but need not always be.

Adaptive Reuse/Continuing Use. Sites allocated to this category may be useful for current administrative or other management purposes. This category applies mainly to historic structures, but may be appropriate in some instances to prehistoric sites.

Site Condition

Site condition (Fig. 2) is a continuous variable, a point which is not clearly evident in a tree diagram. Three categories are used, "Acceptable" "Excavated", and "Extensively Damaged". These categories serve to distinguish sites with differing levels of information potential. Sites assigned to uses other than Information use are assumed to be in acceptable condition. A division of this sort is obviously an oversimplification, but provides a useful sorting scheme for management purposes. The arbitrariness of any cut-off point for a continuous variable is recognized. Such arbitrariness may be mitigated by the employment of professional judgment. Using the "Percent of Disturbance" attribute of the Region 3 "Archeological and Historical Site Inventory" form (R3 2300-2), sites with 50 percent or less disturbance would be automatically placed in the "Acceptable" category. Sites with between 51 and 80 percent disturbance would require professional judgment as to

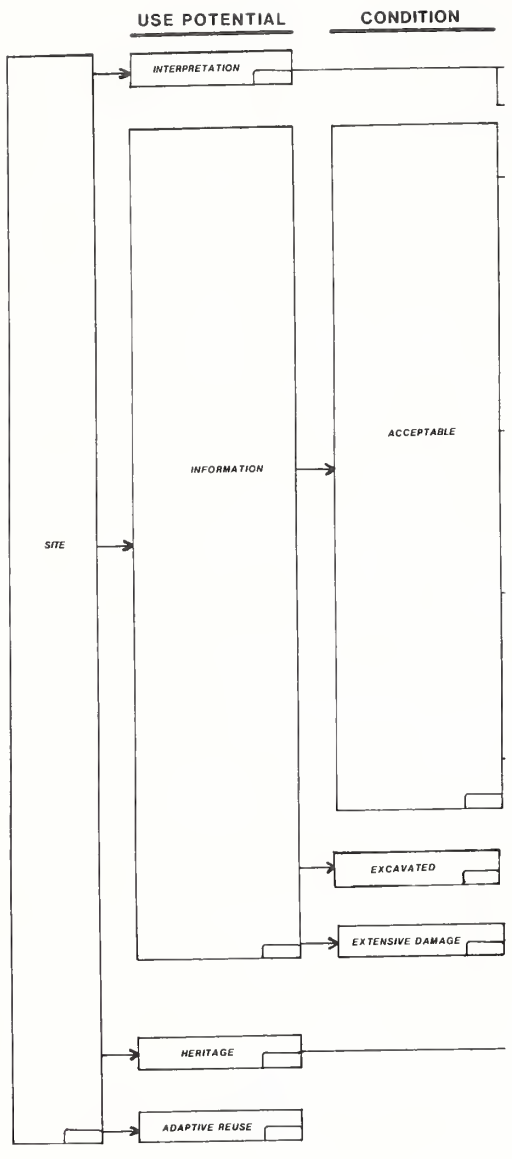

Figure 2. Decision Tree Step 1, Node 2--Site Condition

category assignment. Sites with more than 80 percent disturbance would be placed automatically in the "Extensive Damage" category. Extensively damaged sites will fall into the general pool of sites to be conserved for future use, or if their information potential has been entirely destroyed, will be removed from management consideration.

As can be seen in the decision tree (Figures 3 and 4) the next two categories (Site Use and Site Size) apply primarily to sites with information potential. Site Use and Site Size breakdowns are not generally relevant, for allocation purposes, to sites assigned to interpretation, adaptive reuse, and heritage uses.

Site Use

For sites with information potential, allocation for management and research is based to a certain extent on the type of site being considered. A distinction is made here between habitation and nonhabitation sites (Fig. 3) because of the differing roles such sites played in systems of settlement, land use, and economics. Anthropologists find meaningful patterns in whether or not human populations maintain permanent settlements, where such settlements are located, and the kinds of resource extraction sites used to sustain settlements. Resource extraction sites are often called "limited activity" sites. These sites include locales for hunting, plant gathering, and agricultural purposes, or water/soil control facilities.

Very often it is difficult to distinquish on the basis of surface characteristics whether a site represents a settlement or a limited activity location. This is particularly the case with early sites, many of which cannot easily be assigned to a habitation/limited activity dichotomy. These sites may fall into an "unknown use" category.

Specialized activity sites are those whose functions are not included among the normal daily activities of village life and/or food procurement. These include such resources as rock art sites, quarries, or ceremonial sites. Such sites are relatively rare on the forests; this rarity warrants specific judgmental decisions regarding allocation and action. Some specialized activity sites may be used for information purposes without affecting them (e.g. photographing rock art sites), while use of others (such as quarries) must be controlled to ensure that significant depletion does not occur.

This rudimentary site classification could be further subdivided endlessly. Such subdivisions would be both needlessly complex and difficult to validate. They are difficult to validate because archeological classifications are derived from research

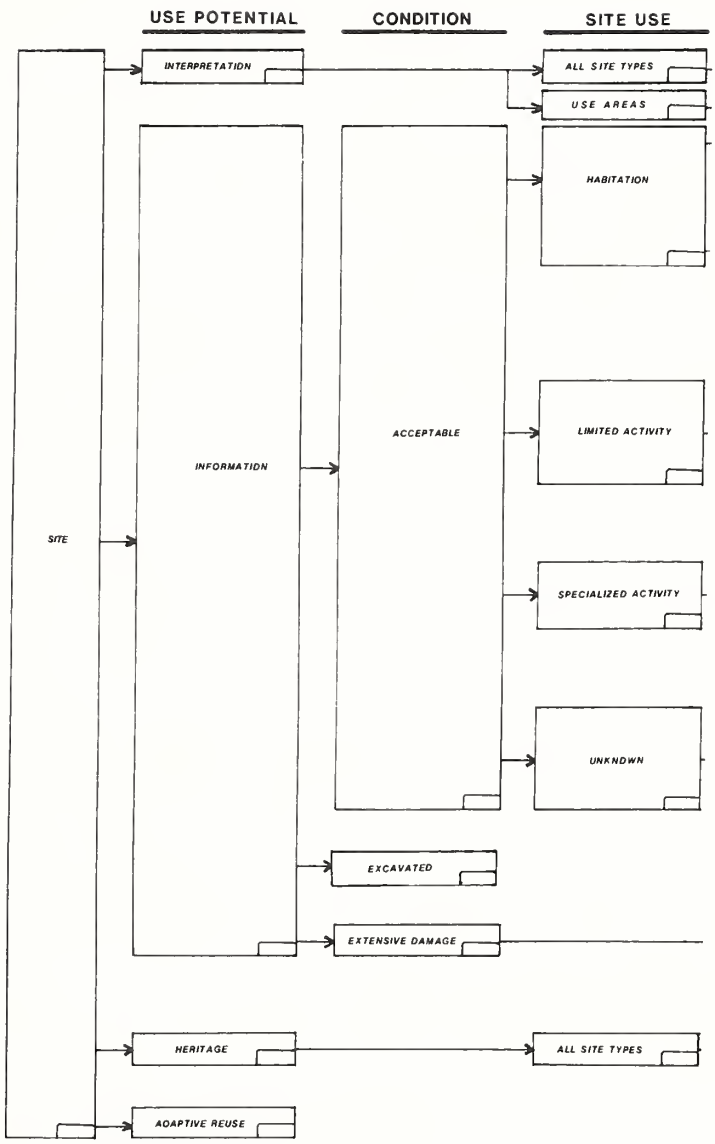

Figure 3. Decision Tree Step 1, Node 3--Site Use

questions, and these will vary among scholars and change through time. The distinction between habitation and limited activity sites, however, is relevant to many of the question posed in the research and development chapter and is likely to remain important to archeological inquiry for some time.

Sites whose use potential is for interpretive or heritage purposes may not necessarily be locality specific. Such "use areas" include defined areas which may be important to particular heritage groups, or areas which may have been the scene of events appropriate to interpretation.

Site Size

As with the "Site Condition" attribute, "Site Size" (Fig. 4) is a continuous variable that may not be easily subdivided.

The manner in which it is subdivided will vary on each forest, depending upon the size range of sites on that forest. The size distinction pertains only to habitation sites. Distinguishing nonhabitation sites on the basis of size is not proposed here. Limited or specialized activity sites that are very large are likely to be impacted by the research needs of the archeological profession at only a minimal level, at least over the life span of this allocation scheme. The same will probably be true of unknown use sites. Additionally, archeological investigation of large limited activity sites may result in their allocation to some other category (such as habitation). The rationale for dividing habitation sites on the basis of size is outlined in the next section.

Allocation 1

At this point in the allocation scheme (Fig. 5) all types of sites, except Adaptive Reuse Sites, are assigned to either a preservation or a conservation category, as defined above. The assignment of sites for preservation is carried out through the selection of a random sample, a judgmentally based sample, or both. A random sample, supplemented by a judgmental sample if necessary, is taken of small habitation, limited activity, and unknown use sites. Because of the rarity of some sites and the use potentials assigned them, only a judgmental allocation for preservation is used. Most forests do not have enough large habitation, specialized activity, heritage or interpretive sites to make practical the selection of a random sample. Sites allocated for preservation by judgmental and random samples are listed separately on the decision tree because the type of sample affects the management action (see p. 43) assigned to these sites once the allocation process is complete.

The purpose of a random sample is to preserve an unbiased sample of sites, free of the problem of selecting for long-term preservation sites important to contemporary concerns. This neutrality is essential for unbiased preservation. Random sampling, however, may potentially fail to select a preservation sample that is acceptably well distributed through time and space. For this reason the allocation scheme allows forest archeologists the option of supplementing the random sample with additional sites selected on the basis of professional judgment. It may also be desirable to stratify the random sample based on altitude. If a site is removed from the preservation pool another site must be selected to replace it, unless the preservation fraction is to be changed. The proportion of sites randomly selected for preservation will vary with the rarity of the different kinds of sites. Sites not selected for preservation will be assigned to the conservation category.

The rationale for separating the large and small habitation sites at the preceding node should be evident at this point. Large habitation sites do not occur on many forests in sufficient numbers to make the preservation of a random sample realistic. A decision to allocate such sites to a preservation category is best made on the basis of professional judgment. Also, on the basis of professional judgment, it may be appropriate to allocate some of these sites to the conservation category for use in the solution of current research questions.

Allocation 2

The conservation category is subdivided into two major classes, Research and Pool (Fig. 6). The first of these includes sites relevant to the research topics discussed previously in this document. Sites that do not fall into the research

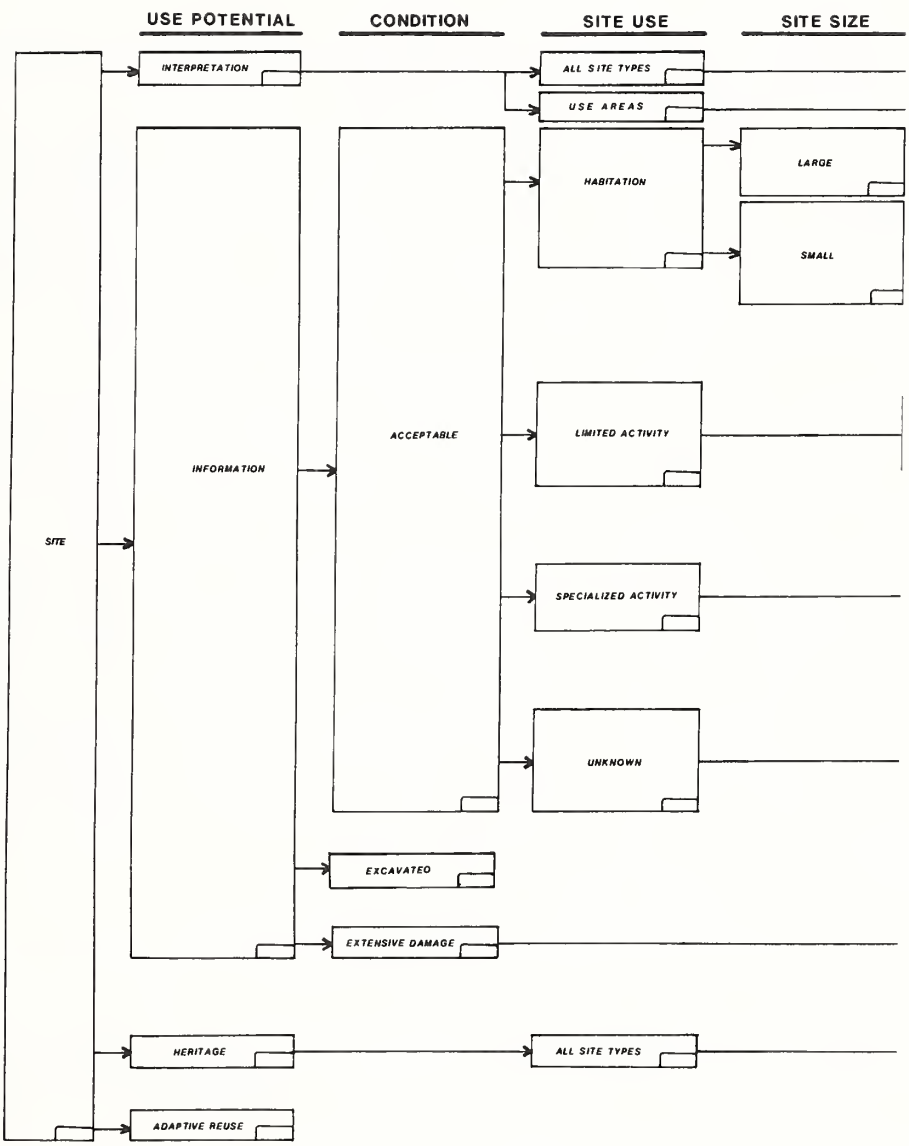

Figure 4. Decision Tree Step 1, Node 4--Site Size

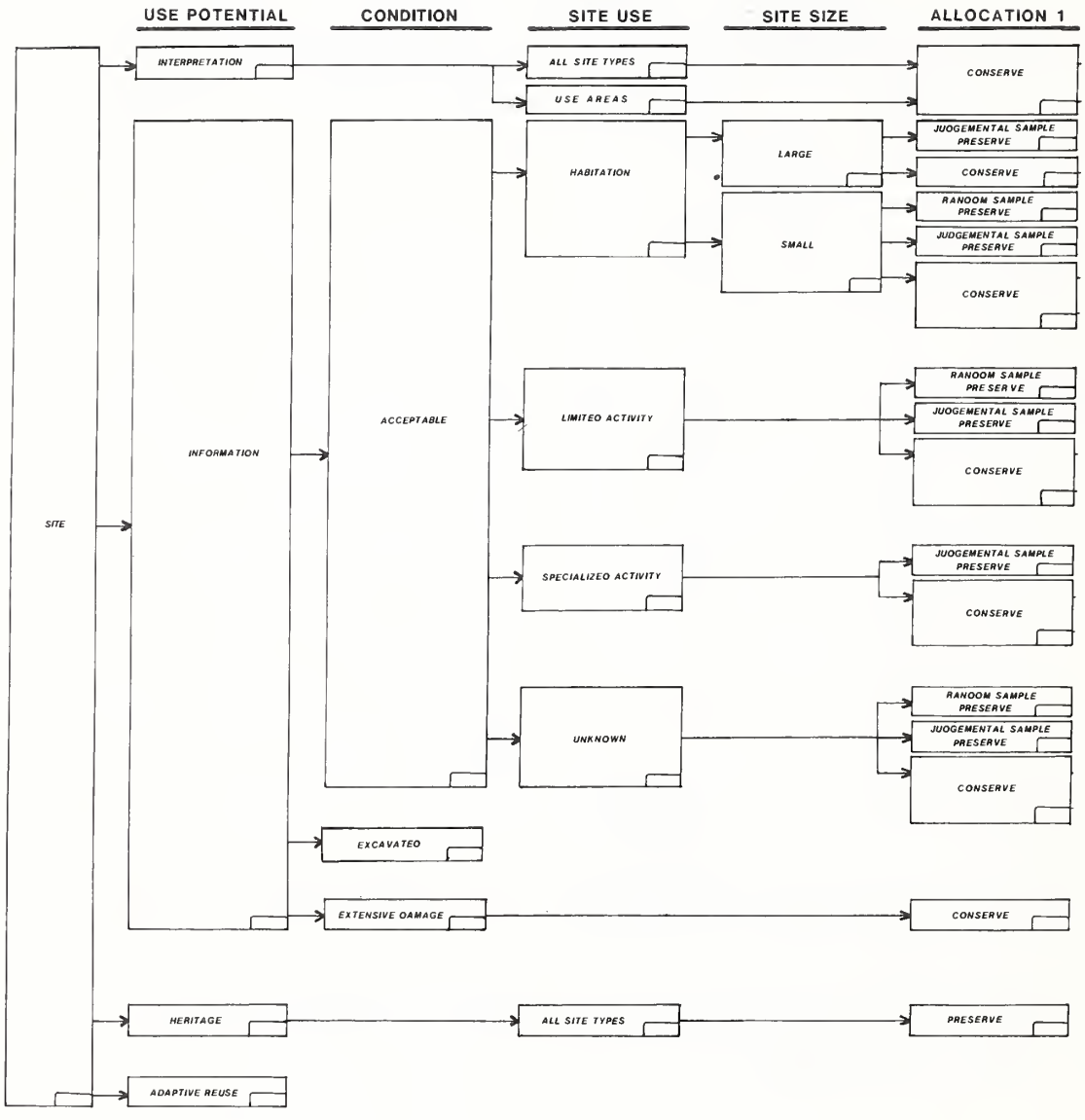

Figure 5. Decision Tree Step 1, Node 5--Allocation 1

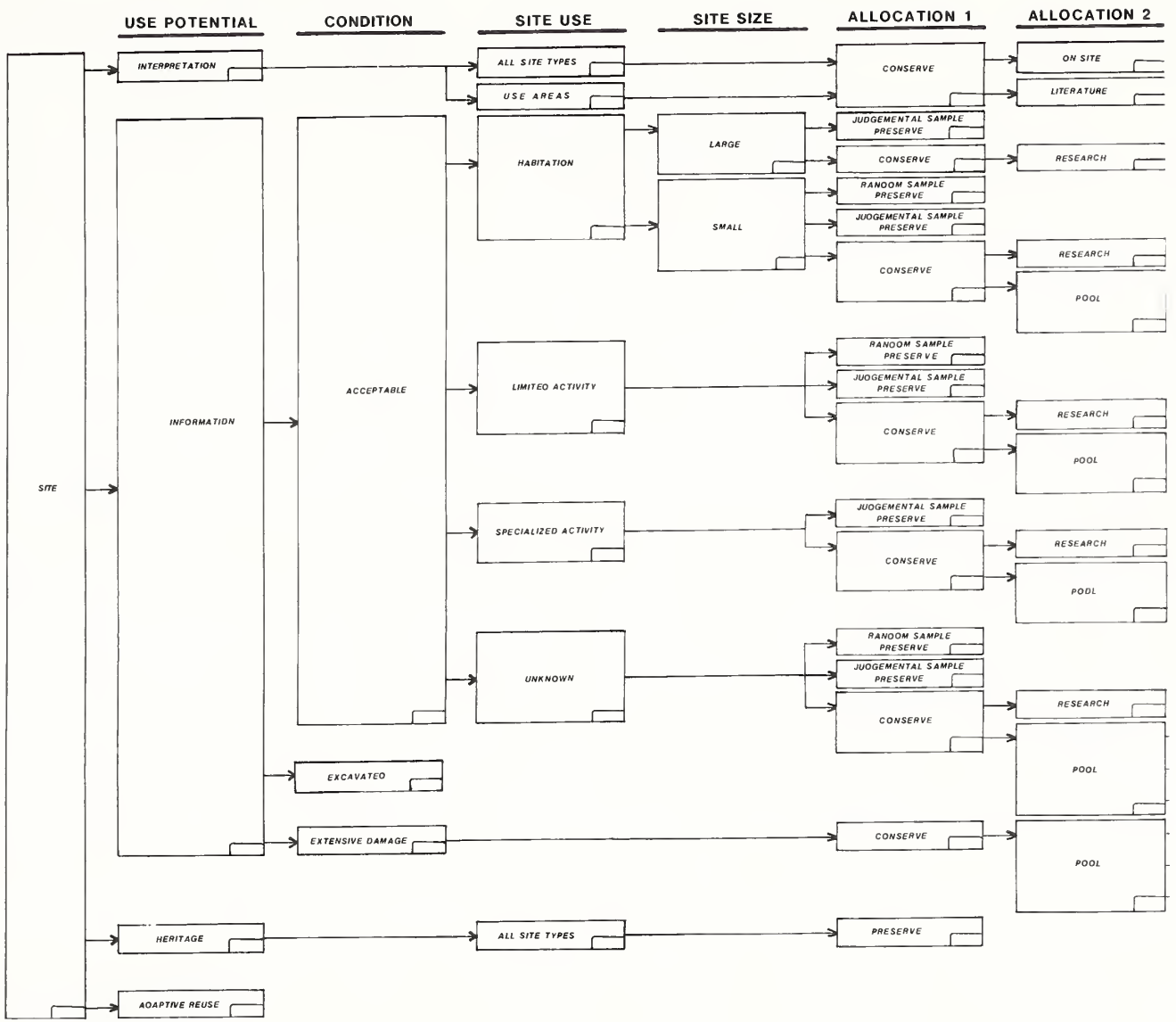

Figure 6. Decision Tree Step 1 Node 6--Allocation 2

category are assigned to a general conservation pool to be managed for potential future use. At present it appears that, given the generality of the research topics identified, few sites will be assigned to the conservation pool. Future consideration of the research topics presented herein (or others) may necessitate shifting sites between these two categories.

Decision Tree Step 2, discussed in the next part of this chapter, outlines the criteria for identifying sites relevant to the Forest research topics. The use of this second decision tree is the basis for actual assignment of sites to the research or pool categories.

Sites with interpretation potential are subdivided into those amenable to on-site interpretation, and those for which interpretation from the literature is practical. This allocation will aid in budgetary programs.

Allocation 3

Sites assigned to the Conservation Pool under Allocation 2 are further subdivided into three categories: experimental use sites, future use sites, and sites removed from management consideration (Fig. 7). Sites allocated for experimental usage are those which may be useful in providing the Forest Service with information about the effects of ground disturbing projects on cultural resources. Sites in the "Unknown Use" category should preferably be used for such experiments. Sites allocated for future uses are those assigned to the conservation pool which are not extensively damaged and which are not amenable to experimental usage.

Sites removed from management consideration are those that have been determined through professional evaluation to possess no information potential. Only sites that fall in the Extensive Damage category may be considered for removal from management consideration at this time. Sites of Acceptable condition may be placed in the "Removed from Management" category after excavation, surface collection or other measures are carried out which exhaust their information potential.

MANAGEMENT ACTION

Based upon the placement of sites within the classification scheme different management strategies are prescribed. These strategies are divided into three categories:

1. No access. Site is not available for disturbing scientific or management activities.

2. Limited access. Site is available for some disturbing activities that do not cause substantial depletion of research or other values.

3. Normal protection. Site is managed for maintenance and wise use of its values.

Some sites will be closed to disturbing investigation for the purpose of long-term preservation (no access). All sites selected by random sample for preservation will have no access. Such sites should be actively protected to preserve their values. Other sites in the preservation category, selected on a judgmental basis, may receive a limited amount of investigation such that the majority of the resource is preserved (limited access). Any investigation of these sites must be designed to specifically address one or more of the Forest Research Topics outlined previously in this document.

Sites not in the preservation category will be accorded the normal protection of Forest Service management. That is, these sites will be protected to preserve their values, while at the same time they are available for studies aimed at the research topics set forth in the introduction and elaborated in the research and development chapter. Some sites in this category may also be allocated for experimental purposes to provide the Forest Service with information about the effects of ground disturbing projects on cultural resources. Sites in the "Unknown Use" category are preferred for use in such experiments. Sites in the "Conservation" category may also be sacrificed to meet other management needs after data recovery has been carried out addressing one or more of the research

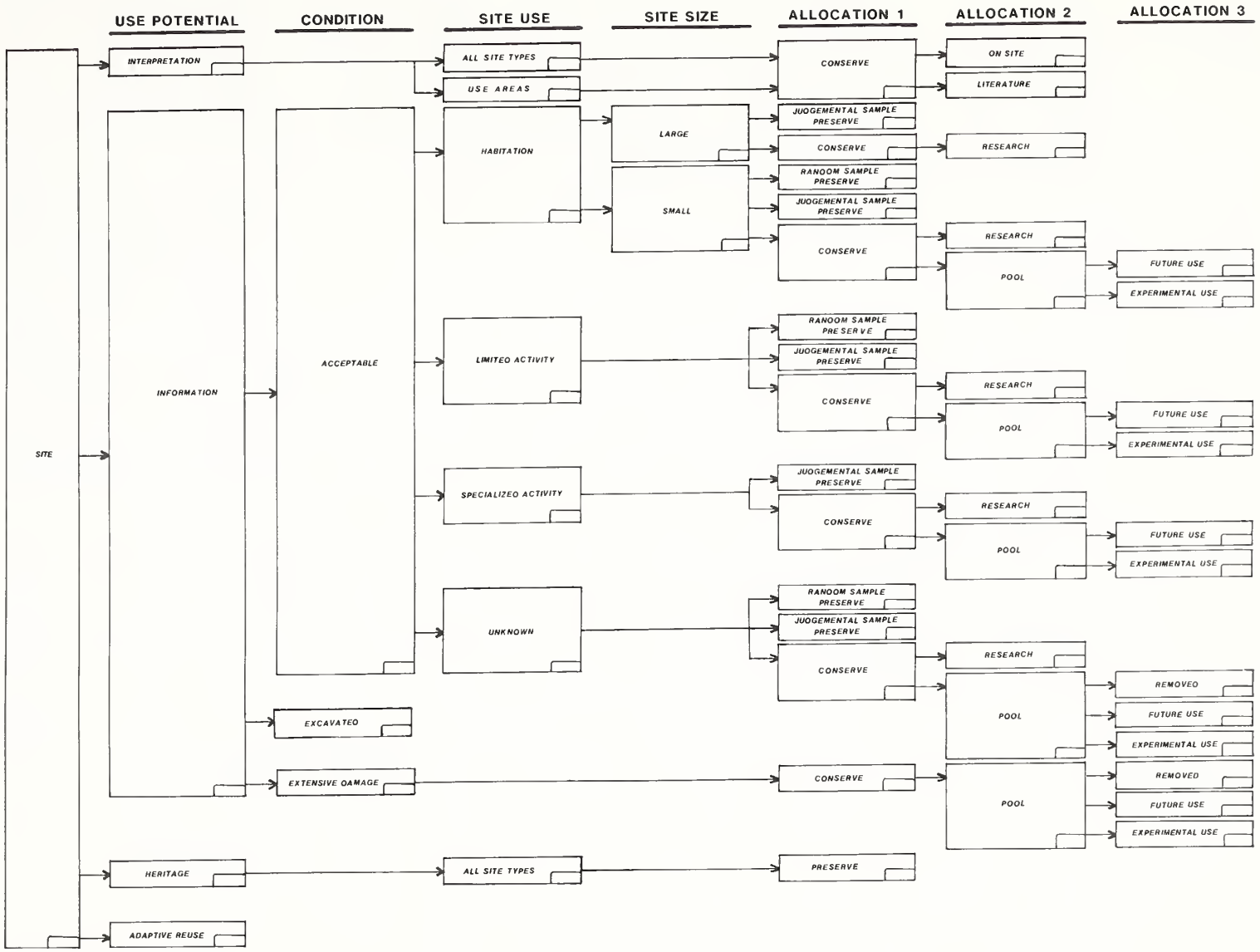

Figure 7. Decision Tree Step 1 Node 7--Allocation 3

topics. Many of the sites managed for their information potential may also have interpretive or heritage values, but these values will not be dominant. Where they are dominant, the site should be allocated to the interpretation or heritage categories.

DECISION TREE STEP 2

Once a site has been keyed through the major allocation scheme, it will be assigned to one of several categories. One of these categories is that of "normal protection," which designates sites to be conserved for either the research topics discussed in the Introduction and the Research and Development Chapter, or for future research topics. These future research sites are assigned to the general "conservation pool." The current research sites are assigned to various research topics on the basis of the key that follows. It should be pointed out that a site may be allocated to more than one research topic. Thus, the final categories of this key are not mutually exclusive. The research allocation categories in the final column of Figure 8 are given by a numeric code. The correspondence of this code to the research topics is given below:

Topic A: Rise and Fall of Civilization

1. Why did prehistoric people begin to live in sedentary communities?

2. What processes are involved in the development of large and complex social systems?

3. What are the causes and effects of the development of agricultural systems?

4. What patterns of productive specialization and exchange existed in prehistoric New Mexico, and what were their causes and effects?

5. What was the nature of ethnic and intercultural relationships in prehistoric, protohistoric, and ethnohistoric New Mexico?

6. What social entities existed in prehistoric New Mexico, and how did their characteristics change through time?

Topic B: Environmental Change

1. What is the history of human land use and its effects on the natural environment?

2. What have been the patterns of natural environmental change over the last 10,000 years or so?

Topic C: Abandonment/Depopulation

1. Why do people abandon sedentary communities?

2. What caused the depopulation of A.D. 1100-1300?

Data Categories

For each of the above topics, the following discussion details the data categories necessary to key out sites relevant to a topic. These data categories are limited by the kinds of information recorded on the R-3 "Archeological and Historical Site Inventory Form" (R3 2300-2). Thus, many categories of the key are rather broadly defined. This being so, not all sites selected by the key will be equally useful for resolving the research topics. When this point occurs, the applicability of a formal decision tree ends, and the professional judgment of individual Forest Archeologists must be employed.

In the discussion that follows, sites relevant to several of the topics are considered in part on the basis of temporal range. The specific dates used will need to be modified on a forest-by-forest basis. For the present discussion, the Cibola and Lincoln Forests are used as examples.

A-1. Sedentism. All sites on both the Cibola and Lincoln Forests, dating between 5000 BC and AD 900 may be pertinent to this research topic. The former date is selected because of persistent suggestions that sedentism in New Mexico may be traceable to the Early Archaic. The latter date represents a time by which sedentism had been established through most of the western two-thirds of the state. All sites dating in this time range are selected because sedentism cannot be understood divorced from a total pattern of land use.

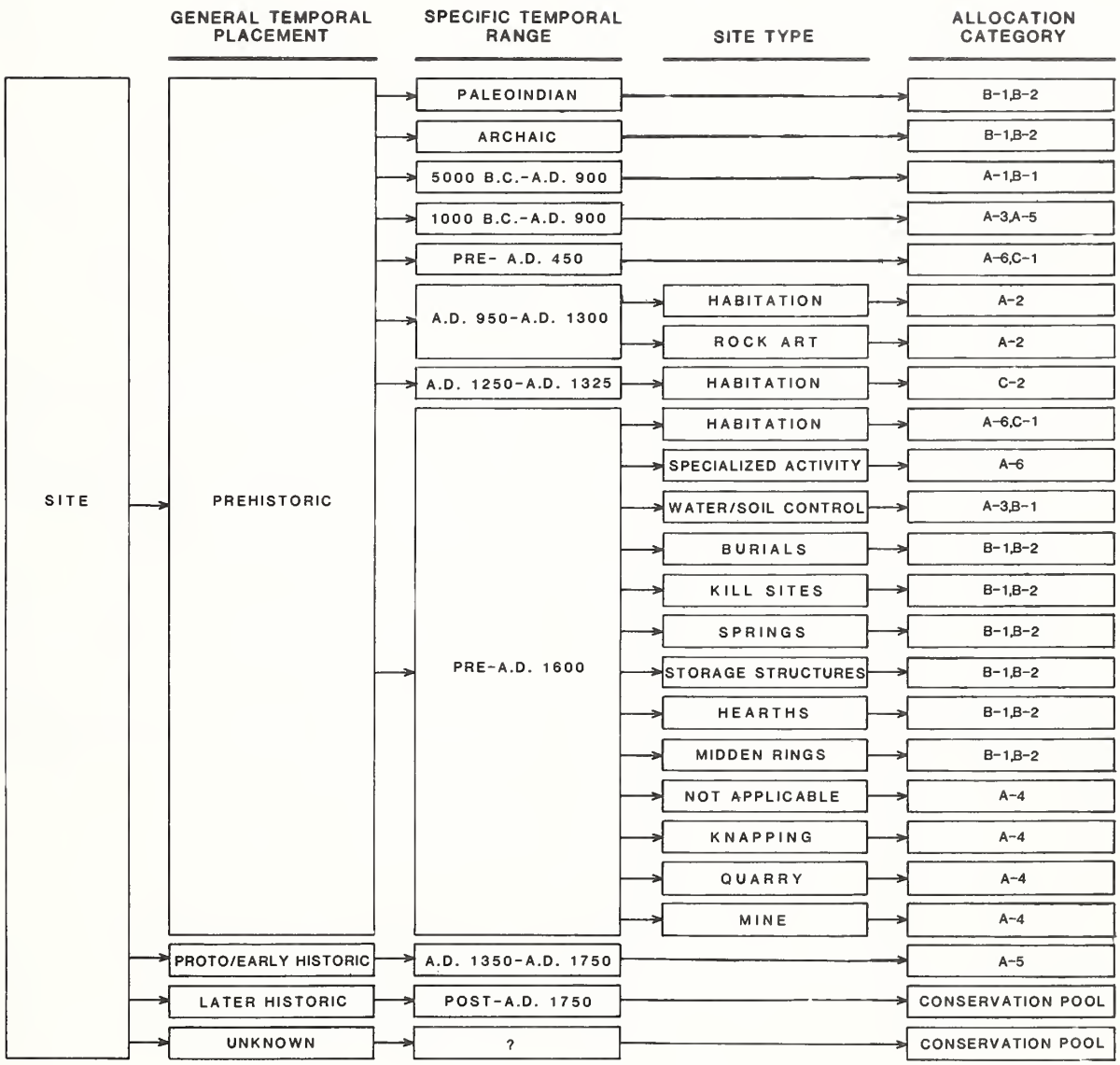

Figure 8. Decision Tree Step 2

A-2. Large, Complex Systems. Habitation sites on the Cibola National Forest dating between A.D. 1100 and A.D. 1300, and on the Lincoln between A.D. 950 and A.D. 1325 are selected. Rock art sites are also included because iconographic representation may vary in relation to the modes of ritual integration practiced by complex socio/political systems.

A-3. Agriculture. On both the Cibola and Lincoln Forests, all sites dating between 1000 B.C. and A.D. 900 are selected. Early evidence of agriculture dates to the Middle Archaic in New Mexico, while by about A.D. 900 agriculture was widespread. Again, all sites dating in this time range are selected because agriculture cannot be understood except in the context of the total subsistence system.

A-4. Product Specialization and Exchange. Since the consumption and use of manufactured items occurred on most sites (by definition--that is how most sites are identified) this aspect of the research topic is not considered critical to the key. Sites that can be identified from the site files that relate to manufacturing include knapping, quarry, and mine locations.

A-5. Protohistoric/Ethnohistoric Periods. All sites on both forests dating between A.D. 1500 and A.D. 1750 are selected.

A-6. Social Groups. Prehistoric habitation and specialized activity sites, and all sites earlier than A.D. 450 are selected.

Prehistoric specialized activity sites are selected because of the relevance of such things as rock art styles and motifs to local and regional social, political, and ritual organization. Since it is often difficult to identify whether early sites were used for habitation, all sites dating before A.D. 450 are selected.

B-1, B-2. Environmental Change. Prehistoric water/soil control sites, burials, kill sites, springs, storage structures, hearths, and midden rings are selected. All PaleoIndian and Archaic sites are selected.

Sites on the first list may contain data relevant to paleoenvironmental reconstruction. All PaleoIndian and Archaic sites are selected because, during periods of the past when the climate was different from today, simple knowledge of where sites are located may help to reconstruct paleoenvironments.

C-1. Abandonment of Sedentary Communities. All prehistoric habitation sites are selected, and all sites dated before A.D. 450. Because of the difficulty of determining whether early sites were used for habitation, all early sites are initially selected as potentially relevant.

C-2. Depopulation. Habitation sites on both forests dating between A.D. 1250 and A.D. 1400 are selected.

C-3. History and Effects of Land Use. All dateable prehistoric sites are selected.

FOREST TEST CASES

Landon D. Smith and Patricia M. Spoerl

INTRODUCTION

This chapter reports the results of two test cases using the allocation scheme developed in the preceeding chapter. The test cases use real data currently in the computerized site files of the Lincoln and Santa Fe National Forests, New Mexico, see Map. These Forests were chosen because they represent two very different situations in terms of the kinds and numbers of sites recorded. Yet both have good data bases in terms of completeness and accuracy of their information content. The original intent of the conference was to use both data bases during the conference. However, since Landon Smith was unable to attend due to illness only the Lincoln National Forest test was run during the conference. The Santa Fe National Forest test was done by Landon Smith in the fall of 1982 following the proceedures outlined by Patricia Spoerl and Joseph Tainter in the preceeding chapter. Some modifications were made to accomodate the Santa Fe National Forest situation and historic data were included.

The Lincoln National Forest data included information from 209 sites most of which are small and few of which have architectural features. The Santa Fe National Forest file contained 3,116 sites at the time the test was made including 185 historic sites. A number of the recorded sites contain structures and while many include less than ten rooms (50%) over 100 sites have more than ten with a maximum size reaching 1,850 rooms.

The Santa Fe National Forest has also expended considerable effort toward improving the quality of the information base through site revisitation. Variables not observed when sites were first recorded have been added and sites which could not be relocated were purged from the file. The end result of this effort is a large file of reliable information that is also relatively complete in terms of the observations recorded. These factors argue that the results will have more meaning in any practical application than would otherwise be the case.

LINCOLN NATIONAL FOREST TEST CASE

Prehistoric sites on the Lincoln National Forest are used to test the initial allocation scheme. This Forest was selected because the small number of prehistoric sites recorded to date and entered in the Region's computerized file enabled allocation testing both with computer manipulation of site information categories discussed in Decision Tree Step 2, and with professional judgment through an examination of the physical site file. The computer allocation was based on the selection criteria listed in Appendix A. The following allocations represent merely a test case. Although actual sites on the Lincoln National Forest are used, this trial allocation is not intended for actual management use. The purpose of this test is solely to demonstrate how the allocation scheme is used, and to show that it does work as a means of determining potential uses of cultural resources.

The Region 3 computerized site file for the Lincoln National Forest currently contains 209 sites coded as "Prehistoric" (includes those labeled Archaic and Mogollon). The code for "Prehistoric" site (Col. 52, A) is used to separate the sites under consideration in this allocation scheme. This was done for the sake of simplicity and clarity although it is recognized that other coding categories (Col. 52; D, E, G, H) which include descriptions such as "Prehistoric and Aboriginal Historic" and "Discontinuous Multiple Prehistoric" will also be used when the scheme is fully implemented. This situation is particularly relevant to research questions involving the protohistoric period. Necessary modifications can be carried out on an individual forest basis.

The following presents the allocation scheme for the Lincoln National Forest in terms of Decision Tree Step 1 and Decision Tree Step 2. It should be read using the two decision trees outlined in the previous section (Figures 7 and 8). In addition, the actual number of sites allocated to each category is displayed in Figures 9 and

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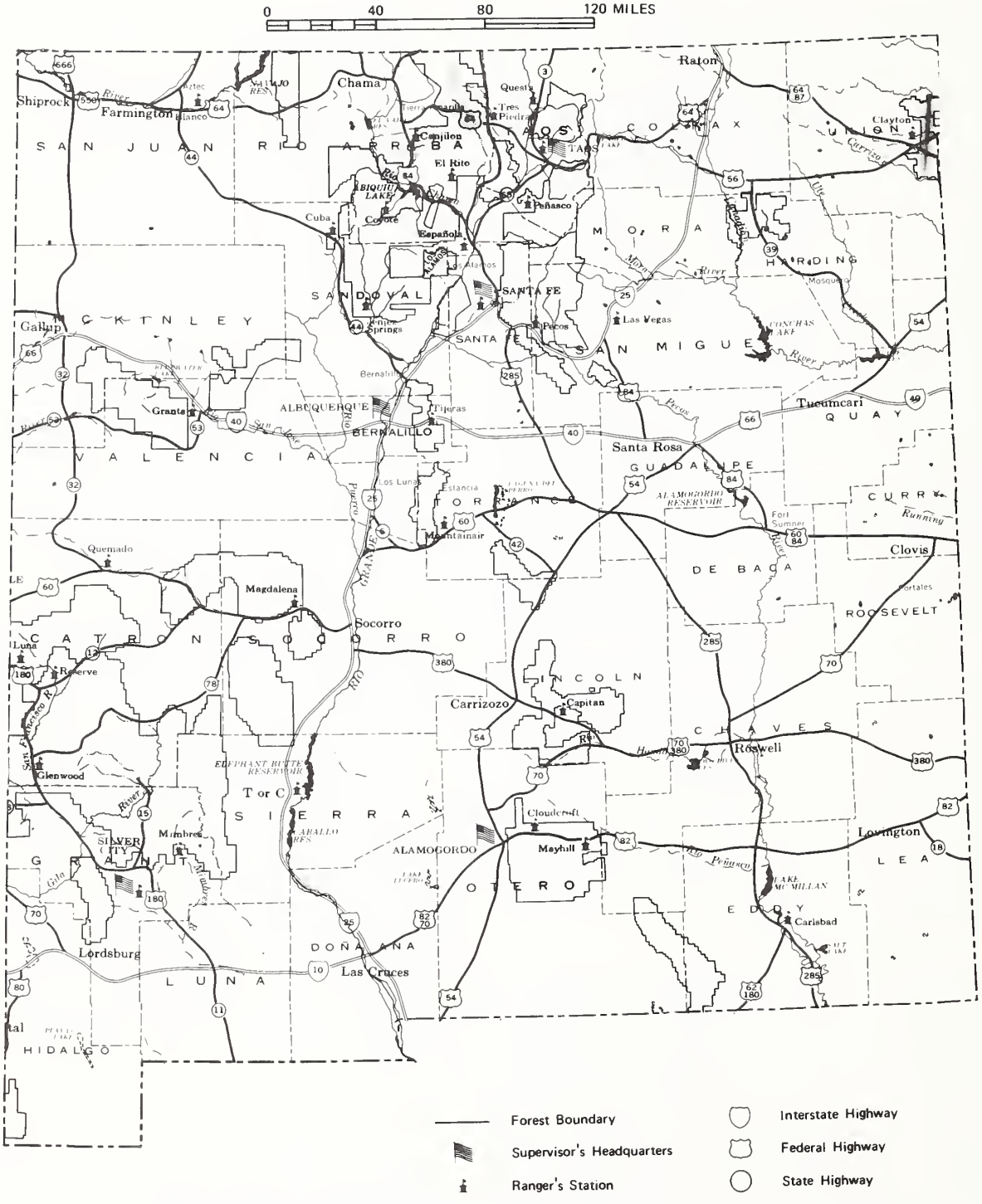

Map. 1. New Mexico National Forests

10. The reader can see graphically the way in which sites are assigned in terms of the two decision tree.

Decision Tree Step 1

Use Potential

At this time all prehistoric sites are assigned to the Information category except one which is placed under Interpretation. As more sites are located and recorded, and as other uses are recognized for management purposes, additional sites may fall within the other Use Potential categories.

Site Condition

Site Condition is determined by the extent of damage a site has undergone. The computerized site file lists 158 sites with less than 50% disturbance (including those sites where the amount of disturbance is unknown). These sites are automatically placed in the Acceptable category.

Forty (40) sites were identified in the 51% to 80% disturbance range. Ten (10) sites had received disturbance amounting to over 80% and are placed in the Extensive Damage category. Examination of the physical files regarding the sites with between 51% and 80% disturbance resulted in the assignment of 35 of them to the Acceptable category and 5 to the Extensive Damage category.

Therefore, a total of 193 sites fall within the Acceptable category and 15 within the Extensive Damage category.

Site Use (Acceptable Sites)

Site Use separates sites into Habitation, Limited Activity, Specialized Activity and Unknown through the use of the computerized file. Decisions regarding the inclusion/exclusion of coding categories with combined uses such as "Limited Activity/Habitation" (i.e., Col. 53; E, F, G) can be dealt with on an individual forest basis. These codes are included in the Habitation category for the Lincoln National Forest test.

Site Size. The subdivision between large and small habitation sites was not made at this time because only 13 definite habitation sites are currently recorded. This situation is expected to change as additional sites are located, and a subdivision into large and small sites could occur in a subsequent review of the allocation process.

Allocation 1

Preservation (Judgment Sample). Habitation and Specialized Activity sites are allocated solely on a judgmental basis. Limited activity sites may be allocated for preservation on a judgmental basis in addition to preservation of a random sample. A judgmental sample was selected on the Lincoln.

Preservation (Random Sample). A 20 percent random sample of Limited Activity sites was selected for long-term preservation. The size of the random sample will vary by forest depending upon the size of the resource base. Because only one site occurs in the Unknown category it is allocated for Conservation rather than Preservation.

Conservation. All sites remaining after the Preservation samples have been selected (a total of 57 sites) are placed in the Conservation category (total of 150 sites).

Allocation 2

Conservation Research. The initial selection of sites for Conservation Research is done by computer sorting in terms of the variables listed in Decision Tree Step 1. The frequency listings illustrate that the Lincoln National Forest contains prehistoric sites appropriate to all of the research topics defined. Virtually all of the sites are appropriate for Topic A, the Rise and Fall of Civilization, although very few sites are relevant to topics dealing with the development of complex societies and product specialization. Approximately 80% of the sites are amenable to topics dealing with environmental change (B). Few sites appear particularly useful for questions of abandonment and depopulation (C).

The frequency listings can be converted to a listing of actual site numbers. Such listings also demonstrate which sites are appropriate to a number of research topics.

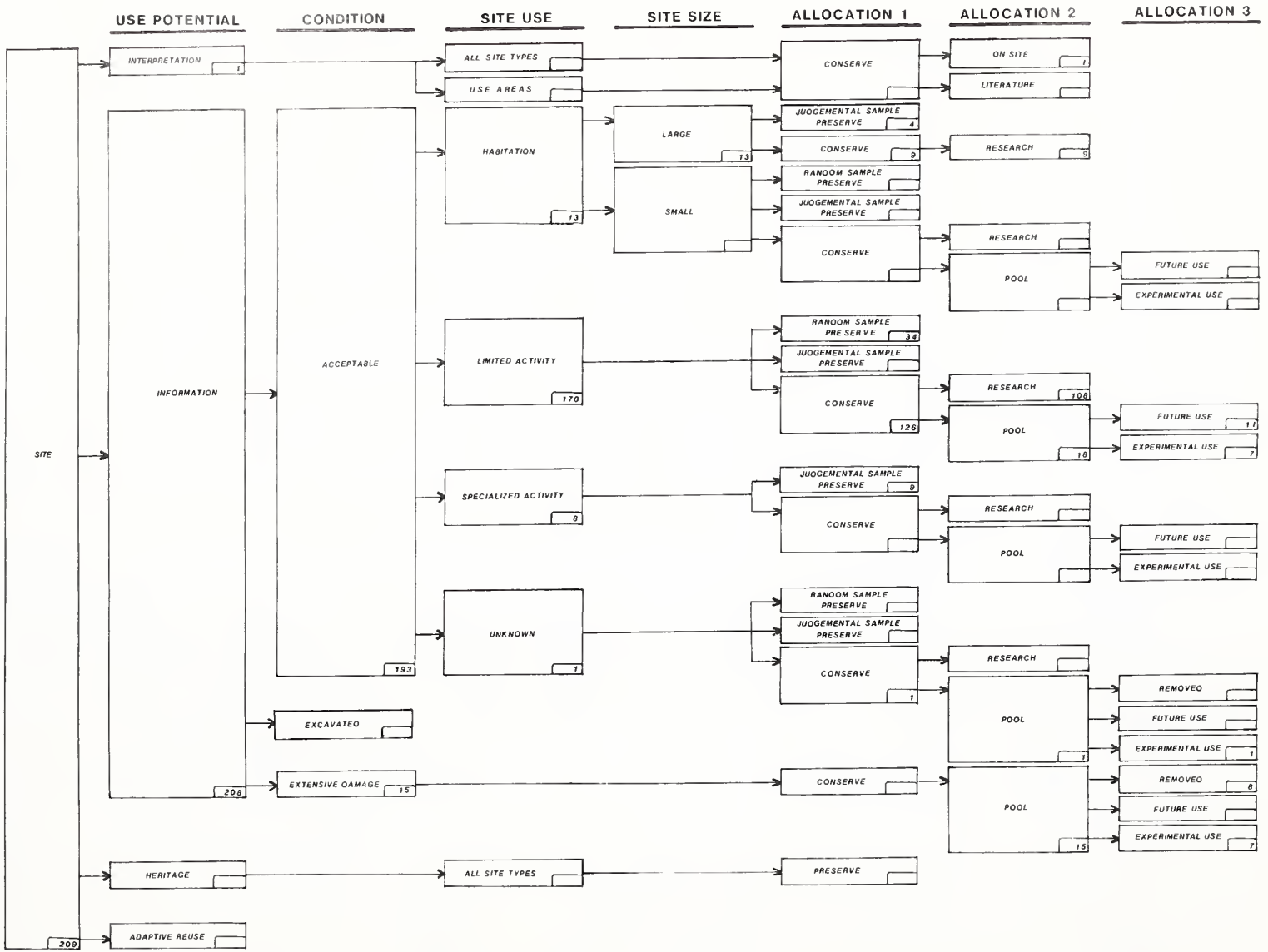

Figure 9. Lincoln Forest Trial Allocation Decision Tree Step 1

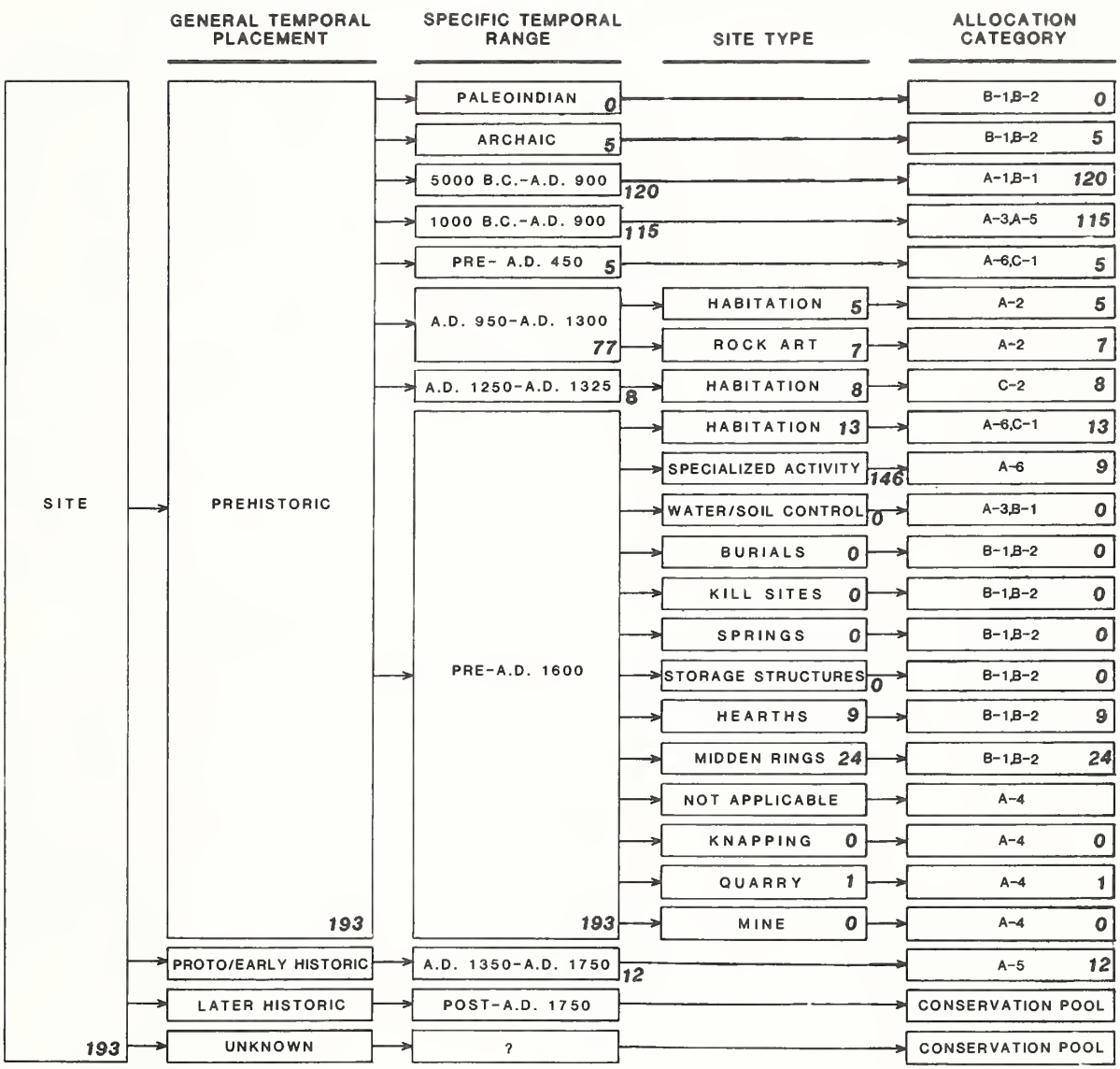

Figure 10. Lincoln Forest Trial Allocation Decision Tree Step 2.

Due to multi-componency, udatable sites and sites bing assigned to more than one Allocation Category, column totals do not match.

On the basis of the computerized sorting of sites, the physical files were examined to make more detailed judgments regarding each site's appropriateness for the Conservation Research category. The majority of the sites (108) were placed in the Research category.

Conservation Pool. Sites which have not been selected for Research in either the frequency listings or on a judgmental basis are placed in the Conservation Pool category. Currently few sites (34) fall in this category. This situation is a reflection of the paucity of archeological data for the forest, the small number of sites recorded, and the general appropriateness of the research topics to a wide range of sites. One reason which exists for placing certain sites in the Pool category at this time is that of site redundancy. Twelve limited activity sites consisting of lithic scatters and midden rings (the most common site type on the Guadalupe District), were allocated to the Conservation Pool for this reason.

Further review of site files and an increase in archeological data for the forest should enable the placement of a wider variety of sites in the Conservation Pool. Sites which have received extensive damage are automatically placed in the Conservation Pool.

Allocation 3

Subdivision of the Conservation Pool sites is done on a judgmental basis. Sites amenable to experimental uses and those removed from management consideration are distinguished. Sites which remain pool ones are classified for future use. Sites in the computerized file were treated as if no management action had been taken. That is, certain sites had been excavated or removed from management consideration because of specific project activities. These previous recommendations and actions were ignored for the purposes of this test. Usage of the allocation scheme over a period of time will result in shifting of a number of sites to the Removed category. Sites removed from management consideration may also be considered for experimental uses.

Decision Tree Step 2

Preliminary computer sorting for Decision Tree Step 2 used all sites in acceptable condition. Figure 10 displays the number of sites appropriate to the various research topics based upon both the computer sorting by SPSS "Select IF" statements (Appendix A) and through examination of the physical files. Computer sorting provides for an initial evaluation of sites, and sorting methods can be modified and refined based upon specific forest data bases. As an example, no protohistoric sites (A.D. 1350 - A.D. 1750) were identified in the Lincoln site files. Examination of the physical files, however, indicates a number of sites coded with a temporal range of A.D. 1 to A.D. 1700 because of the inability of distinguish Archaic and early Apache sites. Modifying the dates in the SPSS statements led to inclusion of 12 sites tentatively relevant to this research topic. Flexibility in altering the ways of selecting the kinds of sites appropriate for specific research topics is critical to gaining a useful idea of the kinds of research topics which may be addressed with the data base of a particular forest.

Management Action. Sites selected for preservation by random sampling automatically are assigned to a No Access category. Sites selected for preservation on a judgmental basis are divided into No Access or Limited Access categories. This allocation is made on a site-by-site basis. It is expected that sites will be shifted between these categories depending upon the amount of research which may be conducted.

All other sites are accorded normal protection.

SANTA FE FOREST TEST CASE

A test allocation similar to that done for the Lincoln National Forest, but employing a larger number of sites, offered the potential for providing additional insight into both the method proposed as well as the general techniques used.

Similar run streams to those designed and used for the Lincoln Forest test were applied, but an alternative set was also used that was more suited to the specific nature of the Santa Fe data base. Such

modifications are anticipated for most forests attempting allocation. Since the writer was unable to attend the conference, the Santa Fe test also served as a trial use by a person not directly involved in the formulation of the scheme.

Decision Tree Step 1

Use Potential

This first step operates somewhat like a rough sort. A combination of judgmental selection based on knowledge of the data as well as some computer aided selection was used. This proved acceptable for several reasons. Selecting sites for both the "Heritage" and "Adaptive Reuse" categories does not readily lend itself to any computer-aided identification. Any sites that meet the criteria for these uses will be well known by anyone familiar with a given site file. We recognized the potential at four sites for adaptive reuse and at 11 sites for "Heritage" management. The sites in this latter category, for example, are all active Native American Religious Shrines identified as such through field observation and confirmed by informants.

A QWICK QWERY computer routine (Appendix B) was used to separate the remaining sites into groups by segregating all sites most suitable for interpretation. While not a sole criterion, any site containing 50 rooms or more was selected for this "first cut." Seventy-three sites met this requirement and selected variables were listed out for each site (Appendix B). The purpose of obtaining a listing of sites is to allow further checking to determine a particular site's suitability.

Site Condition

Recognizing that no single criterion will normally serve at any step in allocation, some, such as "room number" and "percent of disturbance" used at this stage, do help to isolate potential groups. Again, QWICK QWERY (Appendix C) was used to list out all sites with more than 75 percent disturbance, regardless of the type. The approach of listing sites and accompanying variables was used to allow more flexibility in evaluating the sites (See Appendix C).

Some 226 sites are estimated to have 75 percent disturbance. Of these, 82 have been excavated. When these are placed in that category (Fig. 11), 144 sites are left whose integrety has been disturbed to the point where some lower level of management, or none at all, may be appropriate. This leaves 2,802 sites in the acceptable category.

Site Use (Acceptable Sites)

The code in column 53 (site use) was employed for partitioning sites under this criteria. Those that were coded for multiple attribute states (D, E, F, and G) were dealt with by placing them in the Limited Activity category.

Site Size

Here, sites were arbitrarly divided into small sites (1 room) and large sites (2-49) rooms). Recall that all habitation sites with 50 rooms or more have already been selected for the interpretation category.

Allocation 1, 2, and 3

As was done with the Lincoln National Forest, a combination of judgmental and computer aided random sampling (usually of around 20 percent) was used to partition the sites. QWICK QWERY was used to obtain listings of site members and selected variables in order that informed decisions could be made when judgmental selection was done. The results are shown in Figure 11.

Decision Tree Step 2

The final step allocates those sites that fall into certain categories on the basis of their suitability to provide answers to the defined research topics. In a departure from the method outlined for this step, it was decided to assess the total Santa Fe file in order to get an idea of the number of sites presently recorded which could be expected to address specific research issues.

Though the allocation scheme has been presented as a linear method, it is clear that actual application envolves anything but that. For example, the results of allocating all sites using Step 2 early in the allocation process could be quite important. Certain research issues may show a low number of sites that could contain suitable data for their solution.

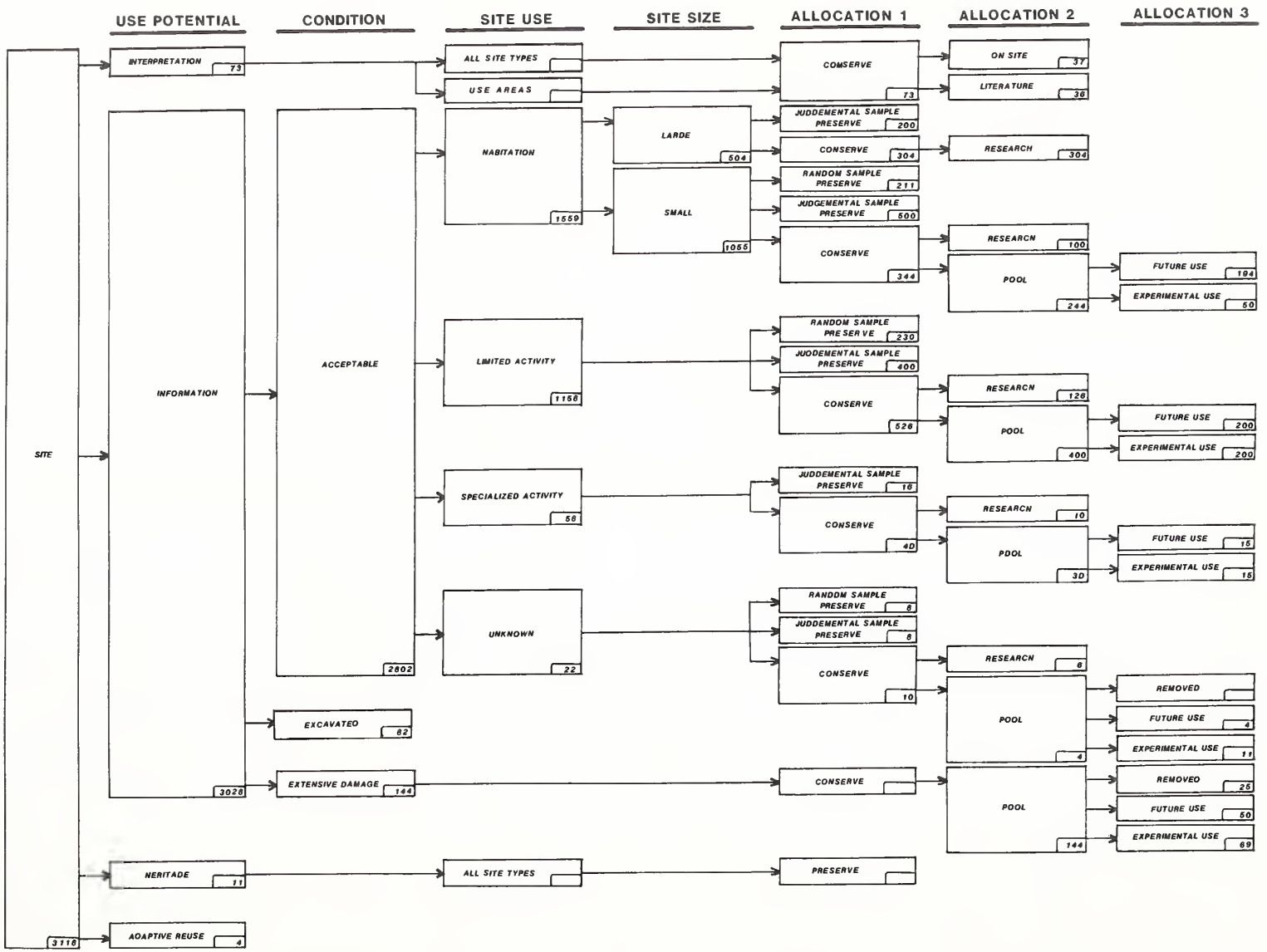

Figure 11. Santa Fe Forest Trial Allocation Decision Tree Step 1. Numbers in the lower right boxes are the number of prehistoric sites allocated to each category.

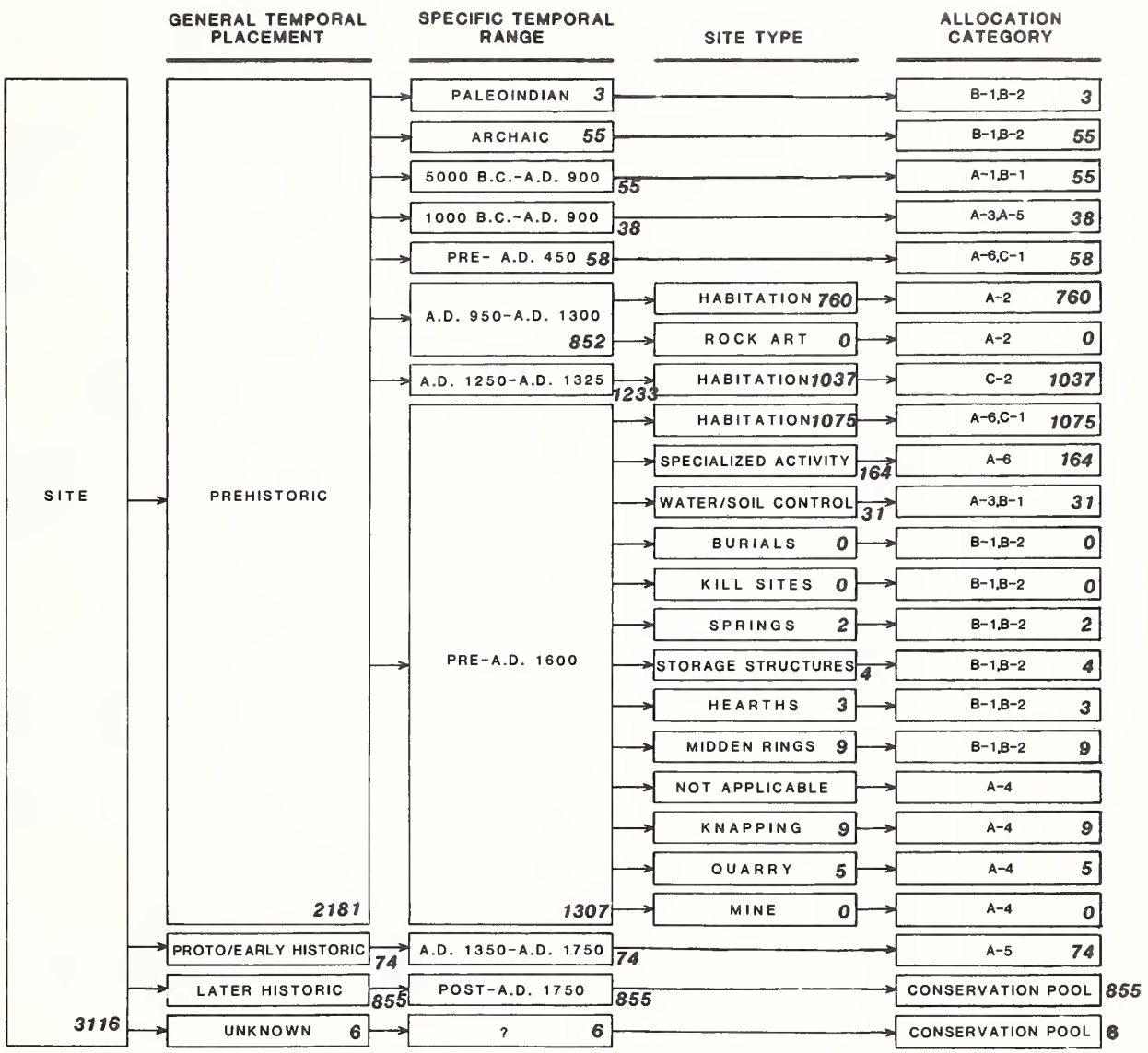

Figure 12. Santa Fe Forest Allocation Decision Tree Step 2.

Due to multi-componency, udatable sites and sites bing assigned to more than one Allocation Category, column totals do not match.

In such situations, this could heavily influence earlier phases of the allocation, particularly where professional judgment plays a role.

In a wider sense, an examination of all of the sites within the Region might be appropriate simply to show the relationship of the current data base to these research questions. The results of this examination would undoubtedly be critical for any actual allocation undertaking.

An SPSS run stream (Appendix D) was written that does the re-coding needed to perform this allocation on the Santa Fe data file. The allocation results are shown in Figure 12 and the computer output in Appendix D.

A test such as this should not be regarded as anything more than a general evaluation of the proposed allocation techniques. The sites "allocated" during the computer runs bear only a rough resembalance to an allocation of cultural resources.

Such an implementation would necessitate a program of field work including testing and even complete excavation of some sites. A program such as this, would require the expenditure of an appreciable amount of money and time, both of which would require a level of committment to the resource not currently extant.

The benefits of going through this process would be many. They include:

1. A time-and cost-saving approach to cultural resource management since level of management concern would result from the character of a given site.

2. Once sites are wisely allocated, rational management decisions about their use can be made.

3. The potential exists for memoranda of agreement concerning management classes of sites which could simplify project procedures.

Because of extensive inventory on portions of the Santa Fe Forest over the past 6 years, several areas are potential candidates for immediate application of an allocation scheme. These areas are:

1. The Llaves area of the Cuba Ranger District (est. 30,000 acres).

2. The Dome area of the Tesuque Ranger District (est. 12,000 acres).

3. The Jemez Springs Towa Circle (est. 20,000 acres).

4. The Anton Chico Grant, Las Vegas Ranger District (est. 8,000 acres).

Areas 1, 2, and 3 are important areas for timber and area 4 is important range land. As such, numerous land-disturbing projects are underway and planned. Because of the high numbers of sites in these areas, each project will need to allow for a significant amount of time and money to comply with appropriate laws.

Unfortunately, in order to save time and money, sites found are not evaluated. This step of assessing value is a primary component of management. By not evaluating the sites, the Forest will treat each site as if it were National Register eligible, and place the increased responsibility attendent with this class of sites on project administrators.

The step of assessing the value, while it would require an expenditure of funds over and above simple inventory, would provide the information necessary to allow allocation decisions to be made. Truly important sites could be given the attention they require rather than diluting that through trying to treat all sites as equally important.

This allocation scheme provides an acceptable framework through which assessment of value can began objectively and allow the informed decisionmaking so needed in cultural resource management.

Summary

Over 3,000 recorded sites on the Regional automated site file for the Santa Fe and Lincoln National Forests were used to test a two part allocation method. Decision Tree Step 1 has identified sites which fall into four major use categories interpretation, information, heritage, and adaptive reuse. Sites were then allocated to more specific categories for management purposes. Several programs using QWICK QWERY and SPSS were used as aids in assigning

specific sites or groups of sites to the categories. While much additional work will be needed if this scheme is to be actually applied to the Forests, it is clear from the test runs that all sites on the Forests, or a portion, of them, could be partitioned for different levels of management using this method. Furthermore, conducting such an allocation is made significantly easier and more precise through the use of a computer aided approach. It should be emphasized that our final application of this to the Santa Fe National Forest will require a field evaluation of site classes.

IMPLEMENTATION AND MONITORING

Dee F. Green and Thomas F. King

IMPLEMENTATION SUGGESTIONS FOR REGION 3

Development of an allocation scheme for cultural resources is an important concept but of little use unless adopted and implemented by management. In this chapter we suggest a number of ways in which the Southwestern Region can make the scheme a management reality. Implementing a new scheme, however well conceived, will not guarantee success without monitoring of results and the fine tuning necessary when theoretically derived ideas are implemented in practical reality. We therefore suggest a monitoring program as well.

Once management has decided to adopt a scheme such as that proposed in this document, the Forest Service has its manual as the mechanism for implementation. This chapter will therefore contain suggested wording for Forest Service Manual (FSM) 2360, so that if management wishes to proceed with implementation, instructions to the forests are available.

Implementation of a scheme such as the one envisioned can have impacts on other aspects of a program. Two areas where the scheme can influence current procedures are in issuance of special use permits for archeological work and in compliance with 36 CFR 800. Modifications to these two activities are also dealt with in this chapter.

INTEGRATION WITH FOREST PLANS

The Forest Land Management Plan is the primary mechanism for structuring the decisionmaking process with regard to the management of resources on National Forest administered lands. Cultural resource management needs to be fully integrated into this mechanism. The "Analysis of the Management Situation" section of the Forest Plan provides a place where each of the allocation categories can be discussed in terms of the numbers and kinds of sites which have been placed in each category. Site availability for use in addressing the various research questions can also be examined. In addition, "management prescriptions" should be developed for each of the allocation categories in this section of the plan. Since the Forest Planning process is designed to be reviewed and updated every five years, each Forest will have an opportunity to see if the allocation scheme is working and if modifications are in order.

SUGGESTED WORDING FOR REGIONAL SUPPLEMENT TO FSM 2360

2361.13 - Allocation. Cultural resources are not all assigned equal value, nor the same kind of significance. Cultural resources have values which may be held as important by different publics at different times. Determining what those values are and identifying those cultural properties which possess them, is the purpose of evaluation. Allocation is the process by which decisions are made concerning the treatment of cultural properties according to the kind and degree of value they contain. Some properties may have high potential for scientific data; others may hold high interpretive potential; and still others may be of great significance in the history or religion of a local community or group. Some properties may be useful as administrative structures or hold exceptional recreational potential; some, of course, can be assigned more than one value, although a particular value may be seen as primary.

After having identified the several values associated with a cultural property, the manager may then prescribe future management actions for that property by assigning it to one or more management classes. These classes are based upon a framework of recognized values that originates with the evaluation process. A property whose primary value is its potential scientific content, would be assigned to a category of sites which will be managed for long-term preservation, or to a category which will be used to meet immediate research needs. As more and more cultural properties are found and evaluated, it will become

increasingly important to provide a mechanism for recognizing the differing potential value of each cultural property. The land manager needs a framework for making decisions about which properties to protect, which to stabilize, which to interpret, which to excavate, and which to conserve for the future. The allocation process provides this framework.

Although any property considered under this section may be nominated to the National Register, it is expected that the decision to nominate a property will follow other management decisions concerning the relative value and future management of that property. For example, a property whose primary importance lies in its potential for contributing to scientific knowledge in the near future would not likely be nominated to the National Register. Since such a property might be invested in research in the near future, not preserved in place over the long run, placement on the Register would serve no purpose.

Since much of the assignment of significance to a property rests with local communities and groups, it is expected that each forest will coordinate with the State Historic Preservation Officer (SHPO) in the process of evaluating and allocating cultural resources, and will employ systematic methods to elicit the views of local communities concerning cultural values.

2361.13a - Interpretation. Cultural resources have high value for interpretation to the public. They can be used in a wide variety of ways. Such use may include full development, such as using an historic cabin as a "living museum;" moderate development, such as restoring a few rooms in a building for historic display; exhibit, such as artifacts in a case; supervised participation in archeological or historical study; interpretive trails; or other related educational and recreational uses by members of the general public.

2361.13b - Information. Cultural resources are important data sets for establishing reliable facts and generalizations about past human behavior, including former environments within which past peoples lived. Cultural resources provide a unique, nonrenewable data base of value to such social sciences as archeology, ethnology, linguistics, anthropology, history and architecture. They may also be of value to such biological and physical sciences as botany, zoology, geology, hydrology, and climatology in their ability to provide information relevant to environmental change through time.

The following are allocation categories to which sites may be assigned when information is the primary use of the site. It is anticipated that the majority of sites will be assigned in these categories.

1. Preservation. Some cultural resources may have exceptional value for scientific allocation in the future, and should be maintained until such use is appropriate. Such resources should be reevaluated at least every 20 years.

As new techniques for data recovery are devised a supply of cultural resources needs to be available for use. Whenever possible, cultural properties which present important opportunities for future uses, should be preserved from premature consumption.

2. Conservation. The wise use of cultural resources, that is consumption, in a planned and orderly fashion with the value (information) of each property made available to the public is the conservation approach. Most sites will probably be assigned to this category. When sites are selected for use, a research design which focuses on the Forest Research Topics should be employed.

3. Experimental. In order to more effectively manage cultural resources, some may be allocated for experimental use or uses. For example, an archeological site may be used to test the impacts of timber felling and skidding or an historic trail may be used to assess human impacts. Any experimental use must be devised and executed in a systematic manner sufficient to produce reliable facts and generalizations about the problem(s) addressed.

4. Remove from Management Consideration. Cultural resources assigned to this category should include those which can be demonstrated to have lost their value or values, have been completely destroyed, or

have redundant information. For example, an archeological site that has no value for interpretive, scientific or other use may be removed from management consideration. Since this action constitutes a management decision that makes a commitment of cultural properties, it requires compliance with guidelines in FSM 2361.8.

2361.13c - Heritage. Some cultural resources have religious, mythological, spiritual, or other ideological (symbolic) value to a discrete group or groups of people. Sites of heritage value will include, but may not be limited to those addressed in the American Indian Religious Freedom Act. These properties may or may not be subject to the compliance requirements outlined by the Historic Preservation Act of 1966 (FSM 2361.8), but should be carefully considered in any allocation. Frequently, cultural properties of this class can be associated with intense feelings on the part of social or ethnic groups associated with them and a special effort may be needed to achieve appropriate and publicly supported management goals.

2361.13d - Adaptive Reuse. Where cultural resources are, or there is an intent to make them, useful for current administrative or other useful purposes, they should be listed in this category. Cultural properties being reused, or rehabilitated for adaptive use should be treated sensitively and in accordance with the guidelines and standards in this section or available from other agencies and sources such as the National Park Service Technical Preservation Service.

2361.13e - Implementation. The allocation scheme will be implemented on a forest-wide basis. A decision tree for assigning sites in the allocation scheme is contained in the publication: PROBLEM ORIENTATION AND ALLOCATION STRATEGIES FOR PREHISTORIC CULTURAL RESOURCES ON THE NEW MEXICO NATIONAL FORESTS. This publication also contains suggestions for using the Forest automated site file to assist in the allocation.

SUGGESTED MODIFICATION TO CULTURAL RESOURCE SPECIAL USE PERMITS

Persons who receive cultural resource special use permits to make use of archeological sites on the Forests generally fall into two groups. One group consists primarily of academics, both professors and students, who have personal research interests that require the study of archeological sites. While such studies are positive and appropriate, they require control to ensure that they do not unnecessarily deplete the cultural resource base of the Forests, and to ensure that, where feasible, they advance Forest Service and other management interests as well as personal research goals (for example, by recovering data from a site that is being vandalized or otherwise damaged). The second group consists of contractors, some affiliated with academic institutions, some not, who conduct studies in connection with planning for non-archeological land uses (timber harvests, roads, transmission lines, surface mines, etc.). These studies also need direction, particularly to ensure reasonably consistency among them with respect to site evaluation and treatment recommendations, and to ensure to the extent feasible that such studies contribute information that is useful in addressing significant research topics.

The Forest Service controls the use of archeological sites by archeologists through the issuance and review of cultural resource special use permits. Although the Forest Service does not dictate what research will and will not be done on the Forests, the responsibility it bears for cultural resource management provides a basis for the Forest Service to encourage certain forms of research and to strongly discourage those that appear destructive or counter-productive. The Forest Service is also justified in insisting that contemporary research use be made only of certain sites, while others are retained for periods of time or in perpetuity for future study and other public uses; this is an essential characteristic of management.

We propose, therefore, that the allocation strategy outlined in this volume be used as follows in the issuance and review of cultural resource special use permits.

1. A copy of this volume should be provided to each current permit holder, and to each permit applicant in the future.

2. Where a permit applicant proposes to address one of the Forest Research Topics outlined in Chapter 1, or one

of the Research and Development Topics discussed in Chapter 2, using a site or sites allocated to this purpose through the process set forth in Chapter 3, and the applicant is qualified to undertake the research, the permit should be issued.

3. Where a permit applicant proposes to address a different research topic , or to use a site or sites not allocated to his or her chosen research purpose through the process set forth in Chapter 3, the applicant should be required to explain thoroughly the rationale for this proposal, and this rationale should be reviewed carefully by the Forest and Regional Archeologist to determine whether the permit should be issued.

4. Where a permit is issued to allow a contractor or other party to undertake research in connection with land-use planning, the permit should be conditioned upon the applicant's agreement to address one or more of the Forest Research Topics and/or Research and Development Topics in the course of the research.

5. Work conducted under permit should be monitored as discussed later in this chapter.

RELATIONSHIP TO COMPLIANCE WITH 36 CFR PART 800

Each activity undertaken by, assisted by, or permitted by the Forest Service that may effect historic properties requires compliance with the regulations of the Advisory Council on Historic Preservation (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act. Given the large number of archeological properties (one million plus) which are anticipated to occur on National Forest administered lands in the region, and the variety of activities that occur on these lands, the job of complying with the regulations every time an effect on a site may occur in unwieldy, at best.

The Advisory Counsil has a mechanism for reducing the burden of compliance in certain situations, however, called the "Programmatic Memorandum of Agreement." Such an agreement is executed by the responsible agency, the Council, and the State Historic Preservation Officer to cover all actions that occur in a given program, eliminating the need for case-by-case compliance review.

Adoption of the allocation process set forth in this volume will put the Forest Service in a position to execute a Programmatic Memorandum of Agreement covering management of the National Forests in New Mexico, including all activities conducted, assisted, and permitted by the Forest Service on the Forests. Such an agreement would provide that, in making management decisions about archeological sites, the Forest Service would use the allocation process and advise the State Historic Preservation Officer of the decision made and its rationale. In the event of an objection by the State Historic Preservation Officer, the Council would review the case, but absent such an objection, the allocation process would be trusted to ensure appropriate treatment of all properties subject to effect.

A set of proposed stipulations which could be incorporated in a programmatic memorandum of agreement has been developed and is given below.

Proposed Stipulations for Programmatic Memorandum of Agreement

A. The Forest Service (FS) will ensure that:

1. The prehistoric site allocation strategy appended to this agreement is used to structure decisionmaking about the treatment of all prehistoric sites on National Forests.

2. Comenserate with the level of activity each National Forest maintains or has access to a qualified historic preservation officer with appropriate staff and other support to carry out FS responsibilities under this agreement.

3. SHPOs will be advised of each allocation decision made, and will be afforded 30 days to respond. Where the allocation will result in archeological data recovery, the SHPO will be provided with the project research design for review and comment. Should the SHPO object to a decision made with respect to a site on or eligible for the National Register, the FS will consult with the SHPO to resolve the objection, and may consult informally with

the Council. Should the objection not be resolved, the FS will seek the Council's comments pursuant to 36 CFR Part 800.

4. The prehistoric site allocation strategy will be incorporated into each Forest Land Management Plan and the Council and SHPO will be afforded at least 30 days to review and comment on each plan.

5. The FS and SHPOs will meet annually, with such other participants as either may desire, to review progress toward carrying out the allocation strategy.

MONITORING

The function of monitoring is to insure that the allocation scheme is integrated into Forest Service management procedures and that the results of archeological field work do, in fact, contribute information of value. We propose that this be accomplished at two levels, the Forest and the Regional Office.

Forest Level

Once a Forest has implemented the allocation scheme and integrated it with the Forest Plan the scheme will need to be reviewed in connection with the five year planning update cycle. This review should include at least the following two items:

1. an examination of the relative numbers and kinds of sites in the various categories to see if any changes need to be made, and

2. an examination of the prescriptions for the allocation categories to see if modifications are warranted.

In reviewing applications for cultural resource special use permits Forest Archeologists should insure that applicants understand the necessity for designing research that is in harmony with the research questions and that permitees will be expected to report, on an annual basis, their progress toward the solution of any of the Forest Research Topics. Annual reports which do not address this issue are unacceptable.

During the months following submission of annual reports by permitees, but no later than six months from their submission, the Forest Archeologist will prepare a report summarizing the research accomplishments of the archeological investigations performed on Forests and forward this report to the Regional Office. This report will detail progress toward the solution of the Forest Research Topics and offer suggestions regarding specific research questions which are in immediate need of answering.

Region Level

The Regional Office will coordinate information from all the forests regarding the adequacy of the allocation scheme. Should modifications become necessary it will devise mechanisms for making the appropriate modifications. At approximately five year intervals the RO will convene a peer review panel of highly qualified archeologists and others to review progress on the Forest Research Topics. At this time, if new topics need to be devised or present topics modified, this action will be taken.

No later than six month following the submission of annual reports by the Forests, the Regional Archeologist will prepare a Regional Summary Report.

SUMMARY AND CONCLUSIONS

Dee F. Green and Fred Plog

INTRODUCTION

Integrating the management of cultural resource sites with the land managing mission of the Forest Service has, at times, been a frustrating experience. Both archeologists and land managers in the Southwestern Region have been faced with a situation characterized by abundance and density of resources. They have also faced, for the last decade, a philosophy in which a cumbersome compliance process was equated with management. Recently, the Advisory Council has attempted to streamline the compliance process through such mechanisms as programmatic memoranda of agreement. The Forest Service is attempting to integrate cultural resource management into its management framework and philosophy through such mechanisms as its Land Management Planning process. The allocation conference and the preparation of this document constitute a further attempt to integrate cultural resource concerns into Forest Service management and streamline compliance. How, specifically, we think that can be accomplished is the first subject of this chapter.

Although designed to serve the needs of the Forest Service, the outcome of the conference has implications for the profession of archeology as well, particularly as practiced in the Southwest. Our thoughts on the issues affecting the profession are the subject of the second part of this chapter.

WHAT THIS CONFERENCE MEANS TO THE FOREST SERVICE

The results of the allocation conference have provided the Forest Service with a number of opportunities to modify its management of the cultural resource program. Such modifications would enhance the integration of cultural resources into the Forest Service and streamline compliance procedures. A discussion of the important management components follows in the order in which they are presented above.

1. Three forest research topics are developed: (1) Rise and Fall of Civilization, (2) Environmental Change, and (3) Abandonment/Depopulation. These topics represent those broad areas of archeological research which the conference felt could make a substantial contribution to modern life. As such, the topics serve as the underpinning of the allocation scheme. They are the basis, in many cases, for assigning a particular site or set of sites to a category and they provide the rationale for the "wise use" of a site.

2. A series of research questions are developed for each Forest Research Topic. These questions provide a basis for formulating explicit research designs which should seek to illuminate the research topics. Such questions may form the basis for designs of particular mitigation plans by either out- or in-service projects.

3. The current scheme of classifying archeological sites as either National Register eligible, not eligible or unknown is not a management oriented scheme. It provides for no alternative uses. The allocation scheme developed at the conference proposes to substitute the following categories: (1) Interpretation, (2) Information-preservation, (3) Information-conservation research, (4) Information-conservation future use, (5) Information-experimental use, (6) Information-removed from management, (7) Heritage, and (8) Adaptive Reuse. These categories are management oriented, that is, alternative uses are envisioned for the resources. Decisions regarding nomination of a site or group of sites to the National Register would still be made.

4. A two-stage decision tree was devised to assist in assigning sites to the allocation categories. This tree is based on the site's use potential, condition, aboriginal use, size, temporal placement, and type. The tree allows for professional judgment as well as the introduction of additional criteria by a particular forest to meet conditions there. The tree is also tied to the Region's site form and automated computer file so that the

computer can be used to assist in the process. The computer will not do the allocating but it will provide the forest archeologist with counts of the number of sites which could fall into a given category. In addition, the site files provide backup information which will be useful in assigning sites to a category.

5. A series of practical suggestions are made about how to integrate the scheme into Forest Service management. These include: integration with land management planning, modification of FSM 2360, integration with special use permits, and a proposed memorandum of agreement with the Advisory Council to speed compliance. Implementation of the above suggestions is designed to speed overall integration of the allocation scheme.

6. Suggestions for monitoring the allocation scheme are made at the forest and regional level. By suggesting that monitoring be done we hope to insure that bugs in the scheme can be worked out and that the results of the archeological research conducted on National Forest Administered Lands does in fact result in the "wise use" of the resource base being consumed.

By designing the scheme to operate on the Region's cultural resources site file the allocation criteria are essentially derived from data collected from surface manifestations. Where excavation data is available it should, of course, be used but in its initial phases we anticipate that most allocations will be made using data from the surfaces of sites. Initially this will have the effect of allocating sites in greater numbers to some categories. However, as the data from sites improves through more careful surface recording and through excavations designed to test information redundancy the numbers of sites assigned to a category are sure to change. Therefore, the scheme should never be looked upon as static. Sites should be moved from category to category as warrented by the acquisition of new and better information about archeological resources.

Cost-Benefit

Hard dollar figures for benefits are difficult to derive especially since the benefits are expected to be greater over the long term than immediately. As more sites are assigned to the "Removed" category and to categories which require fewer dollars for management, costs will decrease relative to the present practice which assigns inordinate numbers of sites to the National Register Eligible category. Immediate benefits are seen primarily in terms of providing Supervisors with a tool for coping with cultural resources in a management oriented framework and an opportunity to assess the nature of cultural resources on a forest.

The cost in implementing the scheme will vary from forest to forest. Those forests with clean data bases already on the computer should have little cost to implement since once direction to implement is in place the details, including the computer run streams provided in the appendix, are available in this document. Forests who need to clean up errors in their data and/or get their sites on the computer file will face those costs. Again, once their files are in place the information provided herein should be sufficient for implementation. Actually the Santa Fe test case already constitutes a trial of this notion since Landon Smith developed the Santa Fe Allocation trial from a draft of this manuscript without any special training. He was able to follow the allocation scheme designed by Tainter and Spoerl and even make modifications to suit the particular cultural resource situation on the Santa Fe as well as develop additional computer run streams for refining his data.

At this point we want to emphasize to the reader that this document represents a "scheme" for allocating resources not allocation itself. This scheme can be implemented at relatively little cost in a short time frame. The actual allocation of cultural resources using this or any other scheme is a process that will need to be accomplished over many years. This is not to suggest that allocations cannot be made soon after the scheme is in place but rather to remind the reader that continuing inventory and additional information based on excavation will result in continual change in the number of resources assigned to any one allocation category.

Different Forests will face different problems and different timetables when allocating cultural resources. Types of

sites, their numbers, densities, time periods, and size will all be factors influencing how allocation decisions are made. For example, in the trial runs of the Lincoln and Santa Fe Forests there are a number of differences other than just the number of sites. On the Lincoln 13 sites are listed as habitation. This constitutes only 6% of the total sites recorded. On the Santa Fe, however, 50% or 1559 sites are listed as habitation sites. The Lincoln, on the other hand, lists 81% of its sites as limited activity while only 37% of the Santa Fe Sites fall in this category. As a general rule limited activity sites are much less costly to excavate than habitation sites. This suggests that the costs for investigating a sample of Santa Fe sites will be considerably larger than for the Lincoln not just because there are more sites on the Santa Fe but because of the kinds of sites as well. On the otherhand the dollars spent on Santa Fe sites would result in more sites being assigned to low level management categories.

The trial formulations on the Lincoln and Santa Fe resulted in only .038 of the Lincoln sites and .008 of the Santa Fe sites assigned to the "Removed" category. Some managers may be disappointed in these low figures. However, it should be remembered that these formulations were made on the basis of surface information which is inadequate for demonstrating site redundancy. Excavation of a sample of sites thought to be redundant must occur before one could expect much of a rise in these percentages. Since the resource is nonrenewable, highly variable, and spread over a long time period one can expect that the percentages will always be somewhat low.

While the focus for the scheme was on New Mexico Forests it is anticipated that only minor modifications may be necessary for implementation in Arizona. Research questions should remain substantially the same and the scheme already allows for some variation in selection of classification attributes at the forest level. From the national perspective, while most regions might be able to use our four initial allocation categories the rest of the scheme is Region 3 specific and would need modification for use by other Regions. Also, except for the southern portions of Regions 2 and 4 (Southern Utah and Colorado) the major problem areas and specific research suggestions would need to be developed for other parts of the country. The cost of the conference and putting together these results has been under $5,000 excluding salaries.

In summary, provision of an allocation scheme and development of the Forest Research Topics are seen as providing a major step forward for the Region in attempting to actually manage cultural resources. The scheme gives the land manager a set of choices about how to use the resource rather than simply a choice about whether or not to keep an archeological site. The research topics give a rational basis for helping make those use decisions so that the "wisest use" of the resource can in fact be made.

WHAT THIS CONFERENCE MEANS TO THE ARCHEOLOGICAL COMMUNITY

Perhaps the most problematical concept developed during the early years of cultural resource management was "Management Information." Clearly, it was and remains important to distinguish the features of archeology done for management or administrative purposes from that done for purely research ends. However, the opposition of management information to research created more problems than were solved. On the one hand, the concept served as a justification for mediocre fieldwork, analyses, and reporting. On the other, it resulted in a generalized failure to explore the casual and the formal impacts of management needs on research programs.

This document lays the ground work for remedying these and other problems. On the one hand, it recognizes that decisions concerning a variety of research activities are management decisions. On the other, it recognizes that management decisions, whether these concern research or administration, must be based on sound research. More specifically the document embodies the following critical changes.

1. Research directions for the next five years are established. The ultimate justification for cultural resource management and research--the vast majority of which is publically funded--is obtaining information that is in the public interest. Because archeologists work for a variety of

agencies, institutions, and private companies, the coordination of the research effort has been minimal. Surely, there is considerable justification for letting a thousand flowers, a thousand research questions, bloom. There is equal justification for attempting to insure that the more important ones are answered.

2. Problems that will arise in attempting to pursue these research directions are identified. Research designs, because they are most frequently prepared in an effort to obtain funds, tend to emphasize positive aspects of the research process. Barriers to the successful completion of the research are rarely or incompletely identified. For each of the research directions, the document identifies problems that must be overcome and additional research that would serve to resolve these problems. The discussion injects an air of realism into the research process whether on or off the Forest.

3. Means for departing from or changing the research questions are identified. The need for flexibility is recognized. At the same time a considerable burden is placed on the profession, individually and collectively. Individually, departures from the established research directions must be justified. Collectively, progress in resolving the questions must be evaluated periodically and the questions modified or replaced.

4. A research-oriented system of data management is introduced. Most existing archeological management systems are simply lists of sites. Application of the allocation scheme to Forest files results in specific lists of sites that are applicable to particular research questions. Archeologists seeking likely locations for an excavation project will be able to begin their effort within a far more limited universe.

5. An obligation to report to the profession is established. To date, no one has taken the responsibility for summarizing either the empirical or theoretical implications of the totality of yearly research for a state, a Forest, or any other administrative units. Archeologists are able to obtain such information only if they are successful in tracking down a large number of individual reports. This document establishes the agencies obligation to generate a yearly summary of progress in meeting research goals. Such a report will greatly facilitate efforts to monitor growth in our understanding of prehistory from a management perspective, it will also greatly reduce the cost of overviews and plans.

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APPENDIX A: SELECTION CRITERIA, SPSS RUN STREAM, AND OUTPUT FOR THE ALLOCATION SCHEME

SELECTION CRITERIA

The Region 3 Site File provides a ready mechanism for computer aided allocation decision making. Through proper selection of criteria or "variables" in the parlance of the STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES (SPSS) Program, the computer can sort a site file into predetermined categories. These categories might be either allocation categories as such, or categories which can be used by a specialist to make judgments about allocating. The selection criteria listed below represent categories of information used both ways at the conference. They serve as an example of how such criteria can be used, not as "the" criteria for use. We have included the page number of the Regional Coding guide where the variable can be found. The variable numbers and labels are SPSS conventions for use with that program.

SPSS Variable	SPSS Label	R-3 Coding Guide
V34	ECOZONE	18
V53	SITE CLASS	43
V54	SITE USE	43
V55	SITE TYPE	43
V58	FLAKED STONE OBSERVED	46
V60	CERAMICS OBSERVED	46
V70	SITE OCCUPIED FROM	48
V71	SITE OCCUPIED TO	48
V72	DATE BASED ON	49
V108	CULTURAL AFFILIATION	52

SPSS RUN STREAM

The following run stream was used at the conference to produce a listing of Lincoln National Forest data as a test of the allocation scheme. It is followed by an example of the output showing variables 34 and 53 only.

```
@RUN,L/N RO3DFG,1103512303TP,R3ARCH,5,300
@SYM PRINT$,,SITE ID
@ASG,N  DEE GREEN,FOREST NAME
@ASG,A  CRMPROGS.
@ASG,A  CRMDATA/READ KEY/WRITE KEY.
@ASG,T  TEMP. @DATA,I TEMP.
@ADD,D  CRMDATA.SITE-FOREST NAME
@END
@ADD  CRMPROGS.SPSS-SITDCTA
@ADD  CRMPROGS.SPSS-SITDCTB
@ADD  CRMPROGS.SPSS-FOREST NUMBER (DIST--)
@ADD  CRMPROGS.SPSS-DCTNM
@ADD  CRMPROGS.SPSS-SITDCTC *SELECT IF    (V53 EQ 'A' AND (V72 EQ 'C' OR V72 EQ 'T'))
FREQUENCIES      GENERAL=V34
OPTIONS          1,3
READ  INPUT  DATA
*SELECT  IF      (V53 EQ 'A' AND (V72 EQ 'C' OR V72 EQ 'T' OR V55 EQ '016'
                 OR V58 EQ '4' OR '5' OR '6' OR '7' OR '8' OR '9' OR
                 V60 EQ '4' OR '5' OR '6' OR '7' OR '8' OR '9'))
FREQUENCIES      GENERAL=V34
OPTIONS          1,3
*SELECT IF       (V53 EQ 'A' AND (V55 EQ '006' OR V55 EQ '007' OR V55 EQ '008'))
```

```
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V53 EQ 0 OR V53 EQ '  ') OR (V53 EQ 'A' AND V70 EQ 0
                AND V71 EQ 0) OR (V72 EQ 'F') OR (V108 EQ '  '))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V53 EQ 'A' AND (V54 EQ 'A' OR V54 EQ 'H')) OR (V53 EQ 'A' AND
                ((V70       GE       1500)       or       (V71       GE       1500))))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V53 EQ 'A') OR (V54 EQ 'B' OR 'D' OR 'F' OR 'G') OR (V55 EQ
                '010' OR '011' OR '017' OR '018' OR '028' OR '030' OR '153'
                OR      '178')      OR      (V108      EQ      'PALE'      OR      'ARCH'))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      (V53    EQ    'A'    AND    ((V70    NE    0)    OR    (V71    NE    0)))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V70   LE   7000   AND   GE   1050)   OR   (V71   LE   7000   AND   GE   1050))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V70   LE   5000   AND   GE   1050)   OR   (V71   LE   5000   AND   GE   1050))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V70   LE   850   AND   GE   550)   OR   (V71   LE   850   AND   GE   550))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V70   LE   700   AND   GE   550)   OR   (V71   LE   700   AND   GE   550))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      ((V70   LE   600   AND   GE   200)   OR   (V71   LE   600   AND   GE   200))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
*SELECT IF      (V53    EQ    'A'    AND    (V55    EQ    '007'    OR    V55    EQ    '008'))
FREQUENCIES     GENERAL=V34
OPTIONS         1,3
FINISH
@FIN
```

R3 ARCHEOLOGICAL SITE FILE

V34 ECO ZONE

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	2	3.3	3.3	3.3	
FOREST	2	9	14.8	14.8	18.0
WOODLAND	3	49	80.3	80.3	98.4
GRASSLAND	5	1	1.6	1.6	100.0
TOTAL		61	100.0	100.0	

VALID CASES 61 MISSING CASES 0

APPENDIX B: QWICK QWERY RUN STREAM AND LIST OF INTERPRETATION SITES FOR SANTA FE NATIONAL FOREST

The following run stream will generate an output similar to that shown below for each district on a forest. Line "E" in the run stream sets the room size at GREATER THAN 50 for this example but can be altered up or down. The listing is for 32 sites on the Jemez Ranger District of the Santa Fe National Forest. We have suppressed the locational information normally shown.

```
RUN,P/N  SF2LDS,1103512303TP,R3ARCH,10,500
@ASG,A  CRMPROGS.
@ASG,A  CRMDATA/READ KEY/WRITE KEY/
@ASG,T  TEMP.
@DATA,I  TEMP.
@ADD,D  CRMDATA.SITE-SANTAFE
@END
@ASG,T  DATAFILE.
@USE  7.,R3ARCH*CRMPROGS.
@XQT  7.TRIPAC-2
@ADD,E  TEMP.
@SRTFAC  4000,240/A
@QWICK-QWERY
A  LANDON SMITH  SANTA FE NF                                    SITEFILE DCT
B                    POTENTIAL NATIONAL REGISTER SITE ALLOCATION
B                              SANTA FE NATIONAL FOREST
C  DIST       SITE.NO     RM.TOT      UTM.EST     UTM.NO
C  ELEV.01    DISP.AREA   SIT.TYP.NAME
D  DIST       LPS SITE.NO     L
E         RM.TOT      GE      50.
H    RM.TOT
I
I    TOTAL
I    ROOMS
J    ****
K    05
L  RM.TOT     =               SUB.RM         +              SURF.RM
@ADD  CRMPROGS.DICT-SITEA
@ADD  CRMPROGS.DISTRICT-10
@ADD  CRMPROGS.DICT-SITEB
@ADD  CRMPROGS.DICT-SITENM
@ADD  CRMPROGS.DICT-SITEC
@ADD  CRMDATA.SITE-SANTAFE
@FIN
```

SANTA FE NATIONAL FOREST

DISTRICT NUMBER	SITE NUMBER	TOTAL ROOMS	*	ELEVATION (IN FEET)	DISPERSED AREA (IN SQ M)	SITE TYPE
03	1	50		7120	10000	PUEBLO
03	2	750		7240	50000	PUEBLO
03	3	250		7360	36000	PUEBLO
03	5	600		5820	50000	PUEBLO
03	8	350		6080	60000	PUEBLO
03	11	800		7600	300000	PUEBLO
03	12	500		7920	0	PUEBLO
03	18	400		7640	15000	PUEBLO
03	27	100		6880	0	PUEBLO
03	30	300		7620	25000	PUEBLO
03	31	500		7700	50000	PUEBLO
03	199	200		7280	10000	PUEBLO
03	317	65		6720	0	VILLAGE
03	320	250		6760	15000	PUEBLO
03	325	160		6720	0	PUEBLO
03	337	300		6780	15000	PUEBLO
03	400	800		7680	150000	PUEBLO
03	504	150		7700	0	UNKNOWN
03	505	150		7280	3000	PUEBLO
03	530	1199		7600	100000	PUEBLO
03	554	100		7500	0	PUEBLO
03	571	600		7500	350000	PUEBLO
03	572	300		7220	100000	PUEBLO
03	573	600		7500	300000	PUEBLO
03	574	75		7200	10000	PUEBLO
03	575	125		7280	10000	PUEBLO
03	576	1200		7880	500000	PUEBLO
03	578	100		7080	5000	PUEBLO
03	579	200		7760	15000	PUEBLO
03	580	75		7000	10000	PUEBLO
03	647	150		6750	5600	PUEBLO
03	688	100		7260	10000	PUEBLO

1 TOTAL FOR 32 ITEMS WITH DIST EQUAL TO 03
* UTM EASTING and UTM NORTHING deleted

APPENDIX C: QWICK QWERY RUN STREAM AND LIST OF DAMAGED SITES FOR SANTA FE NATIONAL FOREST

The following run stream will generate output similar to that shown below for each district on a forest. Line "E" in the run stream sets the percentage at GREATER THAN 75 for this example but it can be altered up or down. The listing is for 30 sites on the Cuba Ranger District, Santa Fe National Forest showing percent of damage greater than 75%. We have suppressed the locational information which is normally shown between the column headings TOTAL ROOMS and ELEVATION.

```
RUN,P/N SF3LDS,1103512303TP,R3ARCH,10,500
@ASG,A  CRMPROGS.
@ASG,A  CRMDATA/READ KEY/WRITE KEY/
@ASG,T  TEMP.
@DATA,I  TEMP.
@ADD,D  CRMDATA.SITE-SANTAFE
@END
@ASG,T  DATAFILE.
@USE  7.,R3ARCH*CRMPROGS.
@XQT  7.TRIPAC-2
@ADD,E  TEMP.
@SRTFAC  4000,240/A
@QWICK-QWERY
A  LANDON SMITH     SANTA FE NF                                SITE FILE DCT
B                       POTENTIAL NO MANAGMENT OPTION ALLOCATION SITES
B                                SANTA FE NATIONAL FOREST
C  DIST        SITE.NO        RM.TOT         UTM.EST   UTM.NO
C  ELEV.01     DISP.AREA      SIT.TYP.NAMEDIST.PER
D  DIST        LPS SITE.NO        L
E         DIST.PER     GE         75.
H    RM.TOT
I
I    TOTAL
I    ROOMS
J    ****
K    05
L  RM.TOT      =          SUB.RM          +              SURF.RM
@ADD  CRMPROGS.DICT-SITEA
@ADD  CRMPROGS.DISTRICT-10
@ADD  CRMPROGS.DICT-SITEB
@ADD  CRMPROGS.DICT-SITENM
@ADD  CRMPROGS.DICT-SITEC
@ADD  CRMDATA.SITE-SANTAFE
@FIN
```

DISTRICT NUMBER	SITE NUMBER	TOTAL ROOMS	ELEVATION (IN FEET)	DISPERSED AREA (IN SQ M)	SITE TYPE	PONT* OF DIST
02	35	1	8200	0	SURFACE HOUSE	80
02	73	0	7160	0	ROCK SHELTER/CAVE	80
02	80	1	7280	0	SURFACE HOUSE	90
02	123	0	0	0	ROCK SHELTER/CAVE	100
02	124	11	7900	0	ROCK SHELTER/CAVE	100
02	137	1	7490	400	SINGLE UNIT	100
02	176	0	7080	0	AGRICULTURAL AREA	80
02	177	0	7080	0	AGRICULTURAL AREA	90
02	179	1	7120	0	SURFACE HOUSE	85
02	182	1	7120	0	SURFACE HOUSE	90
02	208	4	7600	25000	GALLINAS TOWERS	100
02	297	1	8120	500	ISOLATED CHIMNEY	80
02	574	1	7660	914	PITHOUSE	75
02	599	2	7460	0	UNKNOWN	75
02	603	1	7370	300	PITHOUSE	90
02	613	1	7530	55	SURFACE HOUSE	90
02	618	2	7660	235	PITHOUSE	75
02	627	1	7520	120	SURFACE HOUSE	98
02	628	1	7460	98	SURFACE HOUSE	80
02	629	2	7600	575	PIT-SURFACEHOUSE COMB	75
02	631	1	7660	75	SURFACE HOUSE	75
02	634	1	7200	80	PITHOUSE	80
02	643	1	7250	205	PITHOUSE	75
02	733	0	7640	150	SURFACE HOUSE	100
02	745	0	7380	50	ROCK SHELTER/CAVE	75
02	842	1	7920	37	SURFACE HOUSE	90
02	870	1	7560	36	SURFACE HOUSE	80
02	872	1	7560	34	SURFACE HOUSE	100
02	947	0	8120	19	REFUSE SCATTER	90
02	1000	3	7690	1000	SURFACE HOUSE	90

1 TOTAL FOR 30 ITEMS WITH DIST EQUAL TO 02
* LIST INCLUDES SITES WHICH HAVE BEEN EXCAVATED.

APPENDIX D: SPSS RUN STREAM AND DECISION TREE STEP 2 OUTPUT FOR SANTA FE NATIONAL FOREST

The following run stream can easily be modified to generate information similar to that shown below for any forest with a site file. The table shows output from an SPSSrun using the CROSSTABS routine on variables 55-SITE USE and 70-SITE OCCUPIED FROM. The data are 3,116 sites from the Santa Fe National Forest.

```
@RUN,L/N SF1LDS,1103512303TP,R3ARCH,5,300
@ASG,A  CRMPROGS.
@ASG,A  CRMDATA/READ KEY/WRITE KEY/
@ASG,T  TEMP.
@ADD,D  CRMDATA.SITE-SANTAFE
@END
@ADD  CRMPROGS.SPSS-SITDCTA
@ADD  CRMPROGS.SPSS-SITDCTB
@ADD  CRMPROGS.SPSS-DIST10
@ADD  CRMPROGS.SPSS-DCTNM
@ADD  CRMPROGS.SPSS-SITDCT
RECODE          V70,V71 (BLANK=8) (LOWEST THRU 200=7) (201 THRU 600=6)
                (601 THRU 700=5) (701 THRU 1000=4) (1001 THRU 3000=3)
                (3001 THRU 7000=2) (7001 THRU HIGHEST=1)
RECODE          V55 ('177','601','602','603','604','605','606','607',
                '608','609','610','611','612','613','614','615','616',='1')
                ('016',='2') ('017'='3') ('018'='4') ('010','011','009'='5')
                ('006'='6') ('007'='7') ('008'='8') ('153'='9') ('022','027'='A')
                ('302','303','304','305','306','307','308','309','310',
                '453','454','455'='B') (ELSE='C')
VALUE LABELS    V55 ('1') HABITATION ('2') ROCK ART ('3') KILL SITE
                ('4') SPRINGS ('5') BURIAL ('6') KNAPPING ('7') QUARRY
                ('8') MINE ('9') HEARTH ('A') MIDDEN CIRCLES ('B') WATER SOIL
                ('C') ALL OTHER ('D') UNKNOWN
VAR LABELS      V55, SITE USE
CROSSTABS       TABLES=V55,V54 BY V70,V71
OPTIONS         1
READ INPUT DATA
FINISH
@FIN
```

FILE SITEFILE (CREATION DATE = 11/23/82)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
V55 SITE USE BY V70 SITE OCCUPIED FROM
* PAGE 1 OF 2

V55 \ V70 (COUNT / ROW PCT / COL PCT / TOT PCT)	BEFORE BC 5000	BC 5000- BC 999	BC 1000- 949 AD	AD 950- 1249	AD 1250- 1349	AD 1350- 1749	POST AD 1750	BLANK NO DATE KNOWN	ROW TOTAL
1 HABITATION	1	2	28	760	1037	38	289	0	2155
	.0	.1	1.3	35.3	48.1	1.8	13.4	.0	69.2
	33.3	3.6	73.7	89.2	84.1	51.4	33.8	.0	
	.0	.1	.9	24.4	33.3	1.2	9.3	.0	
2 ROCK ART	0	1	0	0	12	1	15	1	30
	.0	3.3	.0	.0	40.0	3.3	50.0	3.3	1.0
	.0	1.8	.0	.0	1.0	1.4	1.8	16.7	
	.0	.0	.0	.0	.4	.0	.5	.0	
3 KILL SITE	0	0	0	0	0	0	1	0	1
	.0	.0	.0	.0	.0	.0	100.0	.0	.0
	.0	.0	.0	.0	.0	.0	.1	.0	
	.0	.0	.0	.0	.0	.0	.0	.0	
4 SPRINGS	0	0	0	0	2	0	1	0	3
	.0	.0	.0	.0	66.7	.0	33.3	.0	.1
	.0	.0	.0	.0	.2	.0	.1	.0	
	.0	.0	.0	.0	.1	.0	.0	.0	
5 BURIAL	0	0	0	0	0	0	5	0	5
	.0	.0	.0	.0	.0	.0	100.0	.0	.2
	.0	.0	.0	.0	.0	.0	.6	.0	
	.0	.0	.0	.0	.0	.0	.2	.0	
6 KNAPPING	1	9	5	6	8	1	179	2	211
	.5	4.3	2.4	2.8	3.8	.5	84.8	.9	6.8
	33.3	16.4	13.2	.7	.6	1.4	20.9	33.3	
	.0	.3	.2	.2	.3	.0	5.7	.1	
7 QUARRY	0	1	1	0	0	0	15	0	17
	.0	5.9	5.9	.0	.0	.0	88.2	.0	.5
	.0	1.8	2.6	.0	.0	.0	1.8	.0	
	.0	.0	.0	.0	.0	.0	.5	.0	
COLUMN TOTAL	3	55	38	852	1233	74	855	6	3116
	.1	1.8	1.2	27.3	39.6	2.4	27.4	.2	100.0

(CONTINUED)

FILE SITEFILE (CREATION DATE = 11/23/82)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
V55 SITE USE BY V70 SITE OCCUPIED FROM
* PAGE 2 OF 2

V55 \ V70 (COUNT / ROW PCT / COL PCT / TOT PCT)	BEFORE BC 5000	BC 5000- BC 999	BC 1000- 949 AD	AD 950- 1249	AD 1250- 1349	AD 1350- 1749	POST AD 1750	BLANK NO DATE KNOWN	ROW TOTAL
8 MINE	0	0	0	1	0	0	1	0	2
	.0	.0	.0	50.0	.0	.0	50.0	.0	.1
	.0	.0	.0	.1	.0	.0	.1	.0	
	.0	.0	.0	.0	.0	.0	.0	.0	
9 HEARTH	0	1	0	1	3	0	8	0	13
	.0	7.7	.0	7.7	23.1	.0	61.5	.0	.4
	.0	1.8	.0	.1	.2	.0	.9	.0	
	.0	.0	.0	.0	.1	.0	.3	.0	
A MIDDEN CIRCLES	0	0	0	2	6	3	8	0	19
	.0	.0	.0	10.5	31.6	15.8	42.1	.0	.6
	.0	.0	.0	.2	.5	4.1	.9	.0	
	.0	.0	.0	.1	.2	.1	.3	.0	
B WATER SOIL	0	1	0	11	29	3	32	0	76
	.0	1.3	.0	14.5	38.2	3.9	42.1	.0	2.4
	.0	1.8	.0	1.3	2.4	4.1	3.7	.0	
	.0	.0	.0	.4	.9	.1	1.0	.0	
C ALL OTHER	1	40	4	71	136	28	301	3	584
	.2	6.8	.7	12.2	23.3	4.8	51.5	.5	18.7
	33.3	72.7	10.5	8.3	11.0	37.8	35.2	50.0	
	.0	1.3	.1	2.3	4.4	.9	9.7	.1	
COLUMN TOTAL	3	55	38	352	1233	74	855	6	3116
	.1	1.8	1.2	27.3	39.6	2.4	27.4	.2	100.0